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MEDICINE OR MAGNETISM?

A correspondent of the New York *Times*, signing himself "A Parson," wants to know, on behalf of a friend's son, whether it would be best to put the lad into medicine or make an electrical engineer of him. This betrays an adherence to the old traditional idea that some of the professions, if not all, can be taken up practically on the toss of a penny, quite regardless of special aptitude. Probably to-day many young men go into the army, the navy, the church or the courts without any particular predilection one way or the other, simply because they must do something; but they can hardly be expected to shine. As for going into electricity, the requirements are now so severe and exacting the boy can barely get a start unless he is both trained and enthusiastic. Of course, he can pick up a job in the lower walks of the art, if the trades unions will let him; but as for electrical engineering proper, it has absolutely no career for the youth who merely takes it up as a chance alternative to medicine. We do not say that he would be any more successful as a doctor. We do know he would in all probability be a dismal failure as an engineer.

Incidentally, we might note that a change is coming over the scene as to the deliberate selection of electrical engineering as a profession from the outset of training. It is better, and we believe that this opinion is growing in acceptance, for a man to become first an engineer, if his mind is of that class, and then for him to differentiate later as to civil, mechanical, mining, electrical, etc., as his bent and genius test out. Many years ago "electricians" answered easily all the requirements the name would indicate. Then they became electrical engineers, with ten per cent. electrical qualification and ninety per cent. mechanical. Now the field of electricity has so broadened it includes all engineering, in some aspect or another; and given the distinct taste for electrical study, he is likely to be the best electrical engineer and inventor who has been rooted and grounded in engineering of the broadest character. These two views of the situation supplement each other and are harmonious, and although they may not exactly justify the trade school basis of an engineering curriculum, they accord with the latest educational thought.

THREE-PHASE TRANSFORMERS.

The magnetic link which connects the primary and secondary circuits of a transformer is, both in value and time phase, such that the e.m.f. per turn of the two circuits must be the same. A forcible reminder of this condition will follow the reversal of one coil of either of two transformers installed according to the Scott two-three-phase system, which will so change the time-phase position of the secondary e.m.f. as to produce the so-called "reversal of rotation." Similarly, in endeavoring to parallel three-phase secondaries obtained from two separate sets of two-to-three-phase transformers, one finds that, even though the "direction of rotation of the e.m.f's be the same, it is impossible to interconnect the circuits unless the two-three-phase teaser coils be located on the same phase of the primary circuit.

The article by Dr. A. E. Kennelly and Mr. S. E. Whiting in this issue shows in a remarkably clear manner that under no circumstance is it possible to parallel the secondaries of three-phase transformers when the transformation is delta-to-star or star-to-delta in one set, and delta-to-delta or star-to-star in the other. That this

condition has previously not received serious consideration from those engaged in this line of work is, doubtless, largely due to the fact that transformers thus connected require special ratios of secondary to primary turns, and such transformation is seldom or never attempted. While a set connected star-to-delta can be paralleled with one connected delta-to-star, and the $\sqrt{3}$ ratio of primary and secondary coils thereby changed to 3, throughout any standard installation all primary coils are interconnected in the same manner, and all secondary coils likewise similarly connected, so that trouble from inability to parallel the secondaries of several transformers is eliminated. The article furnishes an interesting study in phase transformation in general, and performs a good office in directing attention to one of the limits to the flexibility of the polyphase system in most common use.

REGULATION BY SYNCHRONOUS MOTORS.

Mr. Lamme's Institute paper recently read at Chicago touches a subject which for various reasons has been neglected much oftener than is warranted by its order of importance. From the very beginning of power transmission by alternating currents the regulating value of synchronous apparatus has been recognized, but only in rare instances has it been appreciated to the point of utilization. Several causes have co-operated to produce this neglect. Whether there was more profit in induction motors, a firmer grip on the patent situation or merely a certain inability to deal with the very vexatious question of hunting we will not pretend to say, but the fact remains that at one time the only form of synchronous machine furnished the public without protest was the rotary converter, which particular apparatus, by reason of matters pertaining to its direct-current functions, is in fact singularly ill-fitted to serve the general purposes of regulation. At the present time the great extension of long-distance service and a stronger grip on engineering facts have combined to bring up again the synchronous regulator as a pertinent subject of discussion. Mr. Lamme's excellent paper puts the broad facts in a very clear light, particularly with reference to the use of highly specialized motors designed for minimum cost, for regulating purposes only, either direct-voltage regulation, or modification of the power factor.

While fully recognizing the practicability of this method of working, we believe that it is rather seldom advisable to operate a machine for regulating purposes only. It is generally possible in a system of any size to put part of the load upon large synchronous motors worked at such excitation as shall keep the power factor well within reasonable bounds. It often happens that such a motor will be available in a sub-station where it can be used for general regulating purposes, as well as for modification of the power factor. For example, in cases where direct current is to be supplied, the use of a motor-generator instead of a rotary converter not only gives better general regulation on the direct-current side, but gives admirable control of the system's regulation in power factor and voltage. Where there is no such opportunity in the sub-station, the slightly superior economy of a synchronous machine in first cost and in efficiency when the large sizes are reached, is reason enough for its adoption for some large and steady load. Failing this, a very small concession to a friendly customer will often give such control of his motor excitation as will serve the purpose of taking care of the power factor. Then the question of voltage regulation as such can come up upon its merits. The control given by a synchronous regulator is very complete as regards the total effect, but the question of balance in a polyphase system cannot be entirely neglected, so that we must not disregard the advantages of separate manual or automatic regulators upon the separate branches.

In most practical cases power factor control over at least a limited range is highly important, and we know of no simpler way of securing it than that suggested. In the ordinary transmission system with induction motors the general power factor is undeniably low owing to improper design and unloading of the motors. It is oftener below .75 than above it during the period of full motor load on the system, and then may rise considerably owing to the effect of the lighting load if the proportion of alternating arcs be not too great. Now a power factor of .75 means the wiping out of the gain in copper due to three-phase transmission, and investment in regulating apparatus to obviate this loss is, therefore, fully justified, not to say necessary. If it can be secured quite incidentally as we have suggested, so much the better. If not, Dr. Perrine pointed out in the discussion that specialized synchronous machines can be secured for less than half the price per kilovolt-ampere charged for ordinary generators and motors, so that a remedy can be had cheaply enough. On very long lines where static capacity is much in evidence, a leading current may have to be fought instead of a lagging one. In either case we are disposed to think that synchronous regulating capacity is the simplest way to steady the power factor. A power factor of exact unity is both unnecessary and perhaps somewhat undesirable. It is a point at which the system becomes in some respects sensitive, and a moderate amount of inductive ballast may well be carried. When, however, the power factor so shifts as to affect the capacity of the plant materially or to damage its regulation, it is high time to apply vigorous remedies like the one advised by Mr. Lamme and others.

THE STANDARD PRACTICAL VOLTAIC CELL.

The June number of *The Physical Review* contains an abstract of a paper read last April by Dr. Wolff on the subject of the standard cell, with especial relation to the work of the St. Louis Congress Chamber of Government Delegates. It was pointed out that at the Chicago Congress the international ohm, ampere and volt were all defined, both in the abstract and concretely. It is, however, only necessary to define two in concrete form. The third is then deducible concretely from these by Ohm's law. The ohm was defined as the resistance of a definite column of mercury. The ampere was defined in terms of the action of a standard silver-plating bath or coulombmeter. The volt was defined in terms of the Clark standard cell. It was supposed that these definitions would enable the various governments legally to define their respective electric standards. The results, however, have not been very satisfactory. Although the definition of the ohm has not been criticised, differences of opinion and differences of value have arisen over the concrete volt and ampere, differences that are sufficiently great to be of industrial significance. The e.m.f. stated for the Clark standard cell, under the specifications usually understood, has been found too high by about two-thirds of 1 per cent. The specifications for the preparation and use of the standard silver coulombmeter have been found too meagre, so that different observers obtain different results. Consequently, if one electrician takes a standard ohm and produces a standard volt by using Ohm's law, and placing an electrolytically determined standard ampere through the ohm, he is likely to get an appreciably different volt from that which is 1000/1434 of the e.m.f. of a Clark cell at 15° C.

Even assuming that the specifications for the preparation and use of the silver coulombmeter can be so far improved that the concrete ampere could be reliably reproduced, it would be better to discard the coulombmeter in favor of the standard cell. The standard cell requires much less technique to employ than the coulombmeter, and can also be employed directly by means of the potentiometer through a much wider range of magnitudes than the coulombmeter. It is,

therefore, very desirable to agree upon a uniformly reproducible value of standard cell for arriving at the international volt, and then with the ohm to obtain currents by Ohm's law. For several reasons the cadmium standard cell is superior to the Clark cell, as a laboratory standard. The ratio of the e.m.f. of the cadmium cell to that of the Clark cell is known to a satisfactory degree of accuracy. Consequently, it is a matter of relatively little importance whether the concrete volt is defined anew in terms of the cadmium cell e.m.f. or whether the existing definition, in terms of the Clark cell e.m.f., is corrected. Whichever course is followed, it seems likely that the cadmium cell will be the concrete standard practically used. This amendment of the concrete e.m.f. definition of the Chicago Congress is rendered the more easy, because that Congress left the specifications for the preparation of the Clark cell to a committee, and the committee has failed to report.

To leave the matter untouched at St. Louis would be to perpetuate misunderstanding and uncertainty. So long as the Clark cell is officially gazetted at 1.434 volts, and the ampere is also defined by the coulombmeter, we shall be on the horns of an unending dilemma. On one horn we have the uncertainty of the silver coulombmeter technique, and the variation in results occasioned thereby. On the other horn we have a discrepancy between law and laboratory, and a divergence between the Clark cell volt and the ampere-ohm volt. Dr. Wolff's paper goes on to show that by new and improved methods of preparing the Weston cell its e.m.f. may be reproduced with all the accuracy that is commercially desirable. This matter of the standard volt is both practical and urgent. It is to be hoped that the Chamber of Government Delegates at St. Louis will give it full consideration.

EXTRAORDINARY PHENOMENA OF N-RAYS.

The latest of the various types of radiations discovered and studied during recent years—namely, the N-rays and the N^1-rays—have developed most peculiar properties, some of which perhaps are capable of being utilized for practical purposes. Thus it has been found that certain chemical reactions are always accompanied by the emission of N-rays, while in other reactions, which from a chemical point of view are very similar, no N-rays appear. There appears to be no parallelism whatever between the process activity of the chemical reaction and the N-ray effect, and for this reason a study of the emission of N-rays might enable one to recognize the existence of a certain reaction otherwise masked. Some very interesting biological effects have recently been studied by several French savants with reference more particularly to the variation in the emission of N-rays from the brain of an animal while under narcosis, and to analogous experiments with inanimate substances, like metals. For example, M. Edouard Meyer has found that plants cease emitting N-rays when subjected to the influence of chloroform; and M. Jean Becquerel later found that the same effect may be observed with inorganic sources of N-rays, like calcium sulphide, which, when exposed to vapors of chloroform or ether, cease entirely to emit N-rays.

The question having presented itself, What would be the effect on the nerve centers of animals under the influence of anæsthetics? some experiments along this line were made by MM. Jean Becquerel and André Broca and reported to the French Academy of Sciences on May 24. They subjected dogs to the action of vapors of ether and chloroform and studied the emission of N-rays from the brain substance and from the spinal marrow during the several stages of the experiment. The different narcotic substances have somewhat different effects in detail, but in general the effect is as follows: In the state of high excitement which precedes the stage of narcosis, the brain emits N-rays in enormous quantities. They may be easily observed by means of the decreasing brightness of a calcium sulphide screen, fixed at the end of a lead tube and passed over the brain fissure. When the subject reaches the real stage of narcosis, the phenomena change, the brain no longer emits N-rays and later on N^1-rays appear. The latter are recognized from the fact that the brightness of the sensitive screen, when handled in the same way as before, now increases. It was found that the radiation from the spinal marrow undergoes much smaller variations than that from the brain. The spinal marrow can be studied with great ease on account of the centers of radioactivity existing in it, as located recently by Broca and Zimmern. Here the changes in the emission of N-rays are small, and even after respiration and the activity of the heart have ceased, the rays continue to be emitted from the spinal marrow for about half an hour. The absolute cessation of radiation from the nerve centers for several minutes is a sure sign of death.

In a later note presented by M. Jean Becquerel to the French Academy, other and still more singular observations are recorded. Aluminum and copper are transparent to N-rays, but this transparency ceases as soon as the surface of the metals is subjected to the action of anæsthetics. On the other hand, glass and wood continue to let the rays pass. Moreover, a metal emitting rays from its total mass, like steel or copper in compressed or elongated condition, ceases emitting rays if its surface is subjected to the influence of anæsthetics, while compressed wood does not seem sensible to the action of chloroform or ether. All these facts emphasize the great complexity of the phenomena. Whether, however, the results observed are due to the anæsthetic properties of the liquids used, or to other properties they possess, the report referred to leaves us in doubt. Before it can be safely assumed that inanimate substances are affected by anæsthetics as such, very positive proof will have to be presented. M. Becquerel has attempted to analyze the nature of the molecular vibrations to which he attributed the origin of N-rays and N^1-rays. He distinguishes two different vibrations: First, undulations like those of light waves, which pass through aluminum with a speed comparable with that of light through glass; second, another form of energy which passes through aluminum very slowly and the transmission of which may be arrested at the surface of metals under the influence of anæsthetics.

Further investigation of these extraordinary phenomena will be awaited with interest. The history of the development of our knowledge of radiations is most interesting and peculiar in several respects. It is peculiar that the different kinds of radiation, some of which we now know to be nearly everywhere present, have been overlooked until quite recently, and their intimate study appears likely to remove some of the distinctions between different branches of science, while practical applications of their properties have already been made. We know, for example, that Röntgen rays are useful in medicine and surgery, and radioactivity has recently been applied to the measurement of capacities. Moreover, nothing has contributed more to the development of the electron hypothesis than the study of cathodic rays, and it is not improbable that further investigation will furnish material for a wholly new foundation for the sciences of physics and chemistry. Even more interesting is that, in view of the results from the study of N-rays, we may at least hope that bridging the gap between animate and inanimate nature will not forever remain a mere dream of the speculative mind.

The Institute Trip to St. Louis.

Various details have already been made public in these columns as to the exercises and entertainments proposed for the visitors from abroad arriving here at the end of August to attend the Electricity Congress in St. Louis. A special circular has now been issued on the subject by the Institute. It will be remembered that a special train is to leave New York on September 6, immediately after the visit to Boston and the entertainments in New York. The circular says in regard to these matters:

The chairman of the General Reception Committee, with headquarters in New York, is Mr. J. W. Lieb, Jr., president-elect of the American Institute of Electrical Engineers, and third vice-president and associate general manager of the New York Edison Company. The chairmen of the Local Reception Committees in the order in which the cities are to be visited are as follows: Boston, Mr. C. L. Edgar, president of the Edison Electric Illuminating Company, of Boston. New York, Mr. T. Commerford Martin, editor of the ELECTRICAL WORLD AND ENGINEER. Schenectady, Mr. E. W. Rice, Jr., technical director and third vice-president of the General Electric Company. Montreal, Canada, Prof. R. B. Owens, professor of Electrical Engineering, McGill University. Niagara Falls, Mr. Geo. W. Davenport, vice-president and general manager of the Niagara Falls Power Company. Chicago, Mr. Samuel Insull, president of the Chicago Edison Company. St. Louis, Mr. W. V. N. Powelson, vice-president and general manager of the Union Electric Light & Power Company; Mr. W. A. Layman, chairman Committee of Arrangements. Pittsburg, Mr. Charles F. Scott, chief electrician, the Westinghouse Electric & Manufacturing Company. Washington, Gen. George H. Harries, vice-president Washington Railway & Electric Company. Philadelphia, Mr. Joseph B. McCall, president of the Philadelphia Electric Light Company. The chairman of the Committee on Transportation and Arrangements is Mr. E. H. Mullin.

Arrangements have been made in Boston to receive the visiting members of the Institution of Electrical Engineers at the wharf. The local reception committee in Boston has arranged to take the visiting engineers on a visit to the power houses in Boston, to the Massachusetts Institute of Technology and to Harvard University, where a reception will be held on Saturday, September 3. After the reception the visitors will leave by train for Providence, where they will take the steamer for New York, arriving Sunday morning, September 4. A rate has been made inclusive of all expenses in Boston, from the wharf, including accommodations at the Vendome Hotel and steamboat to New York City, for $13. This sum will cover all expenses from the time the English visitors arrive in Boston on Friday until they reach New York by steamer on Sunday morning.

For the convenience of the foreign visitors arriving at New York on or prior to September 1, and who will proceed to Boston to join the main party, an excursion has been arranged via Newport, leaving New York by steamer on the evening of Thursday, September 1, at 5.30 o'clock. After spending a day at Newport those who go on this excursion will proceed to Boston, arriving there at 7.13 p.m. of the same day, in time to join the main party in seeing Boston on Saturday, September 3. A rate has been arranged for this round trip from New York to Boston, via Newport and direct return, including hotel expenses in Boston, of $19.25, covering return by steamer with the members of the Institution of Electrical Engineers.

The cost of a ticket for the A. I. E. E. special tour, including railroad fares, sleeping car berths, hotel accommodation (St. Louis also), meals and all necessary expenses from New York following the itinerary before outlined and back to New York will be $150. This rate, however, does not include hotel expenses in New York City, or the expenses of the Boston trip—previously referred to—and does not include admission to the grounds of the Louisiana Purchase Exposition.

Tickets for the special trip from Boston to New York, as above outlined, and costing $13, can be obtained on September 2 and on September 3 by personal application at the headquarters of the Boston Local Reception Committee of the A. I. E. E., at the Hotel Vendome, Boston, Mass.

Tickets for trip from New York to Boston and return, as above specified, and costing $19.25, and for special circular tour from New York to St. Louis and return, costing $150, can be obtained by personal application at the headquarters of the New York Local Reception Committee of the A. I. E. E., at the Waldorf-Astoria, between August 29 and September 5, 1904, inclusive.

At Boston and New York headquarters a special representative of the A. I. E. E. will be on hand to facilitate the purchase of tickets and give any desired information in reference to the trips.

Those desiring to purchase their tickets for special trips and circular tour before arrival in the United States can do so through the secretaries of the Electrical Engineering Societies of which they are members, and from whom they come accredited. The secretaries of these societies can transmit such applications with remittance to Mr. Ralph W. Pope, secretary, the American Institute of Electrical Engineers, No. 95 Liberty Street, New York City.

Use of Electrical Current in Boston.

The wire department of Boston, Mr. P. J. Kennedy, commissioner, makes as usual an interesting annual report, copy of which has just been received. The data show a steady extension of underground wires and reduction of poles and overhead circuits. Better work is also noted as to interior construction. The following notes of interest may be quoted as to electrical fires and accidents:

"Of the fires inside of buildings, one was caused by a heavy current of electricity entering building over pipes, melting a hole in gas main and igniting gas issuing from said hole; one was caused by primary current entering building over secondary wiring of same; one was due to an outside cross of high potential and signaling wires; five were due to underground service burn-outs; the others being due to miscellaneous troubles inside of buildings. In two cases heavy currents of electricity entered buildings over pipes from underground electric systems; in one case a fire being started by the igniting of gas (as noted above), in the other case the damage being confined to the melting of holes in certain of the pipes.

"Primary currents of high potential entered five buildings over the secondary wiring of same; in the case of two of the buildings the insulation of individual transformers for same breaking down, the primary and secondary coils coming into electrical connection thereby; and in the case of the other three buildings the wire was fed from the same transformer, and an overhead cross occurred, during a severe storm, between the outside secondary mains and the primary circuit. As a result of primary current entering buildings a slight fire occurred in one building, the damage in the other buildings being confined to fixtures, wiring, etc.

"During the year the total insurance loss from fires known to have been due to electricity was thirty-six thousand five hundred ninety-two dollars and fifty cents ($36,592.50). Of this sum, thirty-five thousand five hundred ninety-one dollars and eighty-one cents ($35,591.81) was caused by five fires. The balance of the fires inside of buildings, twenty-seven (27) in number, were small, they causing an insurance loss of but one thousand dollars and sixty-nine cents ($1,000.69), or an average of thirty-five dollars and ninety-five cents ($35.95) each. The heaviest loss was twenty-three thousand eight hundred eighty-eight dollars and fifty-two cents ($23,888.52), same being for fire which occurred December 9th, at building numbered 195-201 Portland Street. This fire was due to a wireman who had been called in to repair a circuit of incandescent lights which was out of service, on account of fuses in branch cut-out having blown as a result of trouble on circuit, attempting to re-fuse cut-out before he had located and removed trouble on circuit. Immediately beneath cut-outs had been placed some receptacles for inflammable liquid used in finishing furniture. Wireman removed cover from cut-outs and then attempted to put a fuse in cut-out; fuse blew, particles of hot metal from same fell into receptacles before mentioned, an explosion followed, and wireman and other men at work on floor where fire started had difficulty in escaping with their lives.

"There have been but nine accidents during the past year, none of which were fatal. This is a very gratifying decrease from the year 1902, when there were fifteen accidents, two of which were fatal, and from the year 1901, when there were twenty-seven accidents, six of which resulted fatally. Seven of the accidents which occurred this year were to employees of the company upon whose system they were at work when the accidents occurred. Five of the accidents occurred inside of power stations, the other four on outside systems."

The pamphlet is illustrated by a number of views and diagrams with particular reference to some of the more important underground work in the city of Boston proposed or now in progress.

Hydro-Electric Power Installation in Iyo, Japan.

SEVERAL years ago attempts were made by capitalists of the cities of Hiroshima and Matsuyama, Japan, to utilize for electrical purposes the water power of the River Ishite. On account of the fact that the water is used for the rice fields, which are quite numerous in Japan, the farmers in the neighborhood strenuously opposed the scheme of development. Four years were consumed in obtaining the consent of the farmers, at the expiration of which time the country suffered an industrial depression, which caused the promoters to abandon their plans. An attempt to execute the plans at the expense of the city of Matsuyama having failed, the promoters finally applied to Saiga & Co., of Kyoto, who, after careful examination, consented to carry out the enterprise. The Electric Water Power Company was formed having 2,600 shares of stock at a value of approximately $50 each, 1,600 shares being owned by Saiga & Co. and the rest taken by the promoters and the general public. The installation was completed in November, 1902, eleven months after the beginning of the work.

The Iyo Hydro-Electric Power Company has obtained from the Inspector of Communication permission to supply electric light and power to the public. Of the electrical output, a part is transmitted to Matsuyama, a city of Iyo, a part to Dogo, famous for its hot spring, and a part to Mitsu harbor. The power is transmitted over three-phase lines from Yunoyama power station, 3.3 miles, to Matsuyama sub-station, and from there about 5 miles to Mitsu sub-station, and one mile to Dogo sub-station.

In the River Ishite there are many rapids, of which Wakigafuchi is the highest. The quantity of water varies from 40 cu. ft. per second at low water to 100 cu. ft. at high water, the mean flow being about 50 cu. ft. per second. The 260 kw of power developed is obtained from an actual head of about 100 ft., with a steady flow of about 50 cu. ft. per second.

The construction of the canal and other hydraulic equipment was accompanied with many difficulties. Three-fourths of the canal line had to be blasted out of rock along a cliff side. A severe flood washed away a stone weir and covered the foundation of the power house with sand and logs. In spite of these difficulties, however, the hydraulic installation was completed in six months.

Across the stream is placed a straight stone weir 132 ft. long, which dams up the water to a height of 4 ft. from the canal bottom. The water enters the canal about 3,000 ft. from the reservoir, which is located near the plant. Along the cliff at a distance of about 300 ft. from the entrance is placed on wooden sleepers a semi-

FIG. 2.—VIEW OF CANAL AND STEEL FLUME.

circular steel flume 45 ft. in diameter, which connects with the canal. The canal is 4 ft. wide at the bottom and 5 ft. in height. The reservoir is 10 ft. wide, 15 ft. long and 5 ft. high. It contains an iron rack which rests on the bottom and is inclined at an angle of about 60°, in order to arrest all floating material, such as logs, leaves, etc.

A steel pipe line, 230 ft. long, connecting with the reservoir, runs to the foot of the mountain, where the power station is located. The pipe is 3 ft. in diameter throughout its whole length, and is

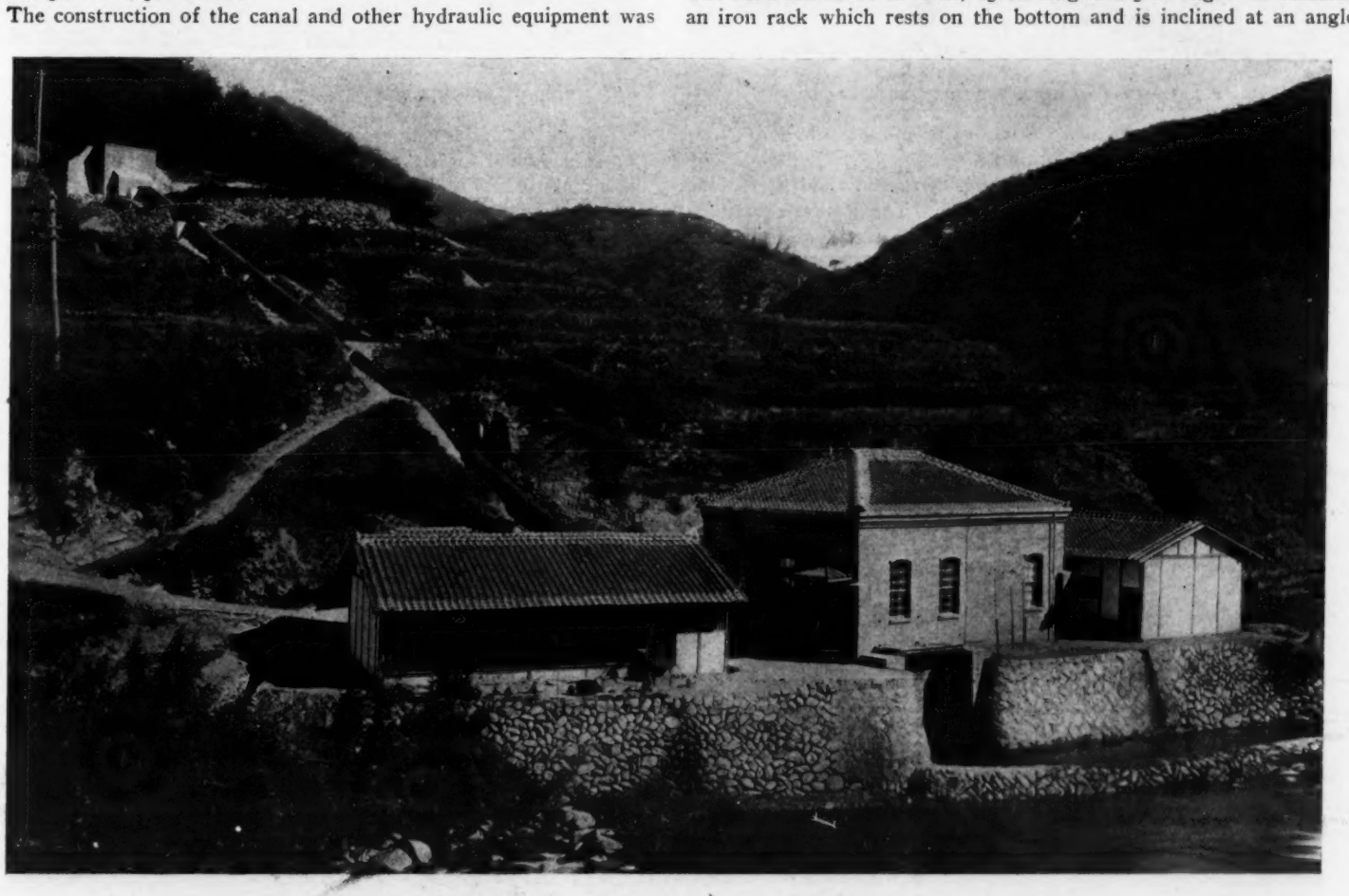


FIG. 1.—GENERAL VIEW OF RESERVOIR, WATER PIPE AND POWER HOUSE.

built of steel plates 3/16 in. to 3/8 in. in thickness, according to the pressure it sustains at different points along the line. At the end

FIG. 3.—TRANSFORMER TOWER IN DOGO PARK.

of the pipe there are provided a safety valve and a manhole to permit of periodically cleaning and draining.

The power house is a brick building 24 ft. wide and 34 ft. long, with the roof truss 16 ft. above the floor. The station contains at present one water wheel, an electric generator and a switchboard. The water wheel, supplied by J. M. Voith, Heidenheim, Germany, is a spiral casing Francis turbine with horizontal shaft, and develops 380 hp at 600 r.p.m., a suction pipe 15 ft. long being used. The regulation of speed is accomplished by Voith's governor, guaranteed to regulate within 3 per cent. The turbine is connected directly through a leather coupling to a three-phase generator of the revolving field type, developing 260 kw at 3,500 volts, the period-

FIG. 5.—MATSUYAMA SUB-STATION AND MAIN OFFICE.

icity being 60 cycles per second when running at 600 r.p.m. The exciter is wound for 110 volts and is placed on the same shaft with the generator. The electrical generating apparatus was supplied by the Allgemeine Electricitäts Gesellschaft, of Berlin, Germany.

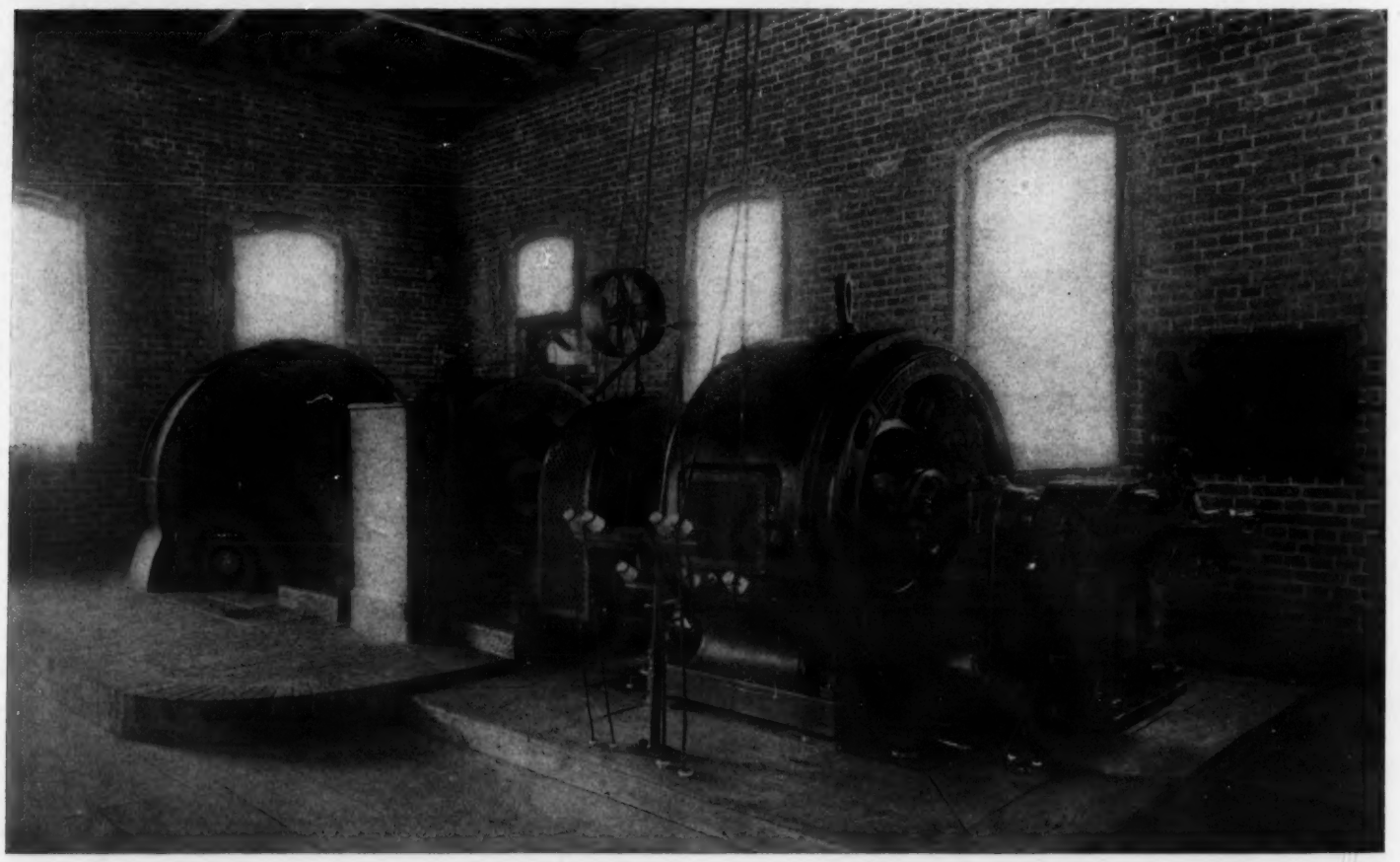


FIG. 4.—TURBINE AND GENERATOR.

The three-phase transmission line consists of No. 3 B. W. G. wires tied to petticoat insulators. Telephone wires are strung on the transmission line poles and serve to connect the stations.

In Dogo park was erected the first transformer tower designed in Japan. It is a brick building 12 ft. high, having an iron pipe reaching 20 ft. above the top of the tower. The primary and secondary wires enter by way of the pipe. The tower contains two transformers of 10 kw each, and later a switchboard will be installed.

At present there are 75 companies supplying electric light and power throughout Japan. Among these the Iyo Hydro-Electric Power Company occupies ninth place with respect to the number of lamps. This good showing may be attributed to the low charge of

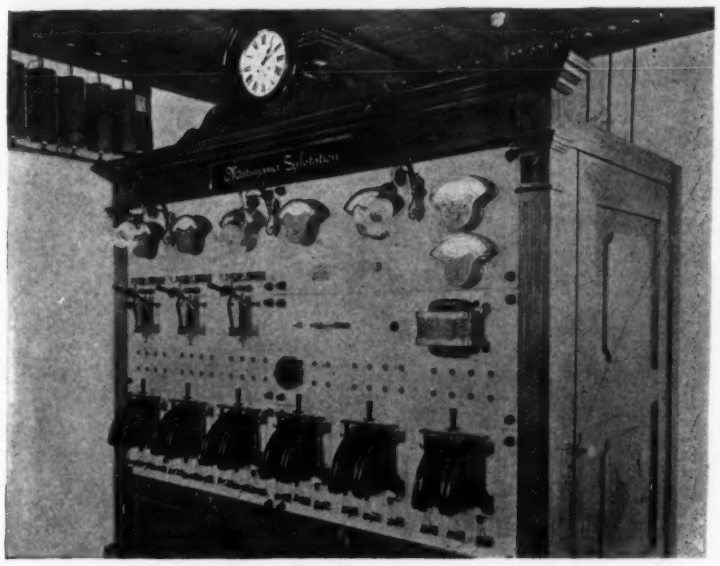


FIG. 6.—SWITCHBOARD, MATSUYAMA STATION.

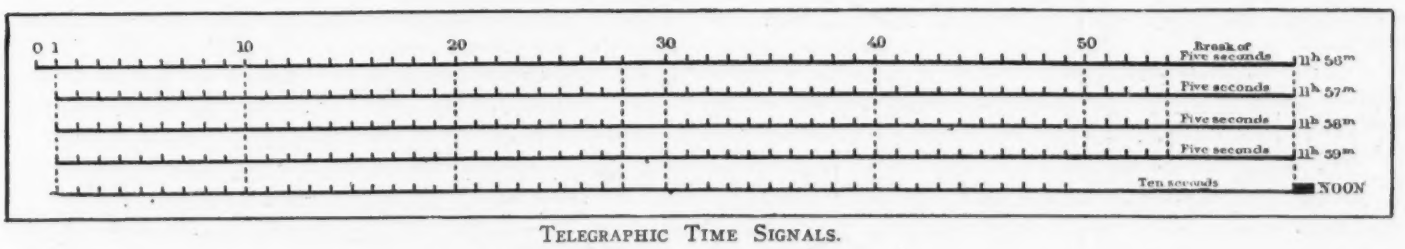
64 cents per month per 16-cp lamp, and 60 cents per month for each outdoor lamp, fixtures being supplied by the company. When the company began operations only 7 kw were used for power, but as the economy of electric service became better known the use increased and about 50 kw are now employed in the various industries such as paper mills, corn mills, weaving looms and chemical works. In order to extend the industrial use of the power, the company is offering a sliding scale of charges which vary from about $8 per month for 1 hp to $190 per month for 30 hp.

Mr. T. Saiga, of Saiga & Co., is at present director of the company and has complete control of its affairs.

Telegraphic Time Signals.

As is well known, the United States Naval Observatory at Washington sends out at noon daily, Sundays and holidays excepted, telegraphic time signals. The entire series of noon signals sent out daily over the wires is shown graphically in the accompanying diagram. This represents the signals as they would be recorded on a chronograph, where a pen draws a line upon a sheet of paper moving along at a uniform rate beneath it and is actuated by an electromagnet, so as to make a jog at every tick of the transmitting clock. The electric connections of the clock are such as to omit certain seconds, as shown by the break in the record. These breaks enable anyone who is listening to a sounder in a telegraph or telephone office to recognize the middle and end of each minute, especially the end of the last minute, when there is a longer interval than is followed by the noon signal. During this last long interval, or 10-second break, those who are in charge of time balls and of clocks that are corrected electrically at noon throw their local lines into circuit so that the noon signal drops the time balls and corrects the clocks.

This series of noon signals is sent continuously over the wires all over the United States for an interval of five minutes immediately preceding noon. For the country east of the Rocky Mountains the signals are sent out by the Observatory at Washington and end at noon of the 75th meridian, standard time, corresponding to 11 A.M. of the 90th meridian and 10 A.M. of the 105th meridian. For the country west of the Rocky Mountains they are sent out by the observatory at the Mare Island Navy Yard, California, and end at noon of the 120th meridian, the standard time meridian of the Pacific Coast. The transmitting clock that sends out the signals is corrected very accurately, shortly before noon, from the mean of three standard clocks that are rated by star sights with a meridian transit instrument. The noon signal is seldom in error to an amount greater than one or two-tenths of a second, although a tenth more may be added by the relays in use on long telegraph lines. Electric transmission over a continuous wire is practically instantaneous. For time signals at other times than noon, similar signals can be sent out by telegraph or telephone from the same clock that sends out the noon signal.



TELEGRAPHIC TIME SIGNALS.

Reducing Friction.

BY ALFRED G. DELL.

In a former article I described an arrangement whereby I suspended a rotating mica disc by magnetizing a piece of steel wire and the steel axle of the disc in the opposite sense. I further stated that I had trouble in keeping the disc in place. Since writing this article, I have discovered a way to arrange a double mica disc so that the friction is reduced to a minimum. This is done by placing the disc on its long axle in a tight box with the lower point of the axle resting in a jewel bearing, the top of the axle being placed very close to the end of a piece of steel wire, the axle and the piece of steel wire being magnetized in the opposite sense.

I found that the disc would always right itself even if it fell away a quarter of an inch at the top, and that it always stopped in one place. The jewel is cup shaped and the disc never escaped from its jewel. It can be easily arranged so that when it falls in any direction it will be arrested before overreaching the effects of the magnetism.

The magnetism reduces the weight of the point in the jewel bearing, and does not in any manner seem to act against the rotations. The magnetism must not be so strong as to lift the disc into contact with the wire at the top, but sufficient to hold it up and make it right itself.

The end of the steel wire is rounded off, and the top of the axle is made in a blunt point; both are highly polished. When the piece of steel wire and the end of the axle have each a small rounded off point, the disc will rotate without the slightest perceptible tremble, unless shaken by some outside means.

Electric Furnace.

It is stated that Prof. Harmon V. Morse, professor of analytical chemistry at Johns-Hopkins University, Baltimore, has perfected an electric heater for laboratory work. The heater consists of an ordinary copper oven encased in a box, doubly lined with asbestos, with an air space between, the whole covered with aluminum paint. The source of heat is in the stove placed within the copper oven. The stove is constructed of parallel slabs of soapstone coated with graphite, the soapstone being unaffected by heat. The graphite is evenly distributed over the slabs of soapstone, that the heat may be developed uniformly over the surface. A constant temperature of 150° can be obtained for eight hours at a cost of ¾ cent.

On the Parallel Working of Delta- and Star-Connected Three-Phase Transformers.

BY A. E. KENNELLY AND S. E. WHITING.

AS is well known, there are four ways in which three transformers may be connected between primary and secondary three-phase mains. These ways are indicated in Figs. 1, 2, 3 and 4. They may be severally described as the Δ Δ, Δ Y, Y Y and Y Δ ways.

It is evident that for the Δ Δ and the Y Y methods of connection only (Figs. 1 and 3) is the ratio of transformation of each transformer the same as the ratio of transformation of the system, or as the ratio of the turns in the secondary and primary windings. For the Δ Y method of Fig. 2, the ratio of transformation is $\sqrt{3}$ or 1.732 times the ratio of secondary to primary turns; while in the Y Δ method of Fig. 4 the ratio of transformation is $\frac{1}{\sqrt{3}}$, or 0.5774 times the ratio of secondary to primary turns. Consequently, special ratios of secondary to primary turns are needed in Δ Y or Y Δ transformers, in order to produce standard transformation ratios, or working voltages between secondary and primary mains. In practice, Δ Y and Y Δ transformers are seldom used on this account.

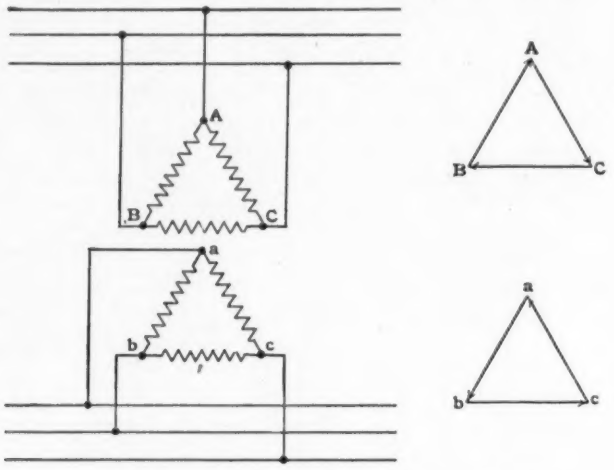


FIG. 1.—Δ Δ CONNECTIONS AND VOLTAGE DIAGRAMS.

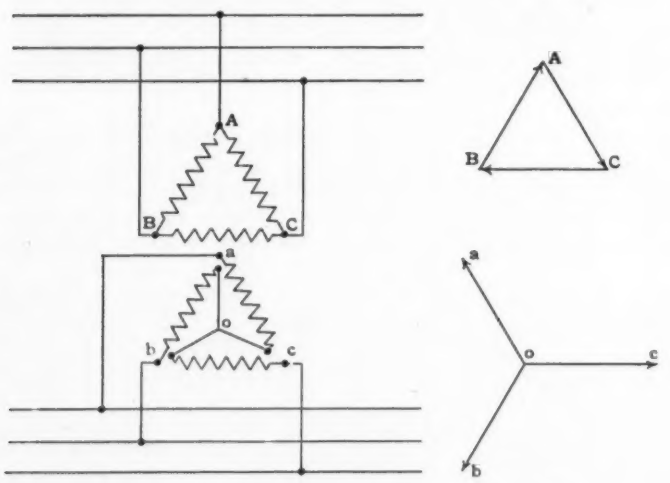


FIG. 2.—Δ Y CONNECTIONS AND VOLTAGE DIAGRAMS.

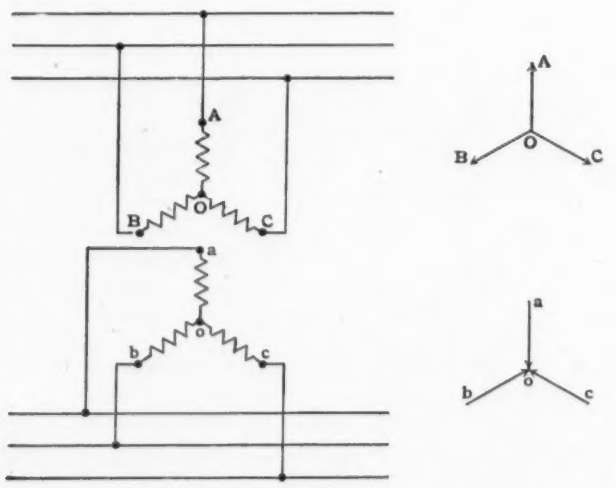


FIG. 3.—Y Y CONNECTIONS AND VOLTAGE DIAGRAMS.

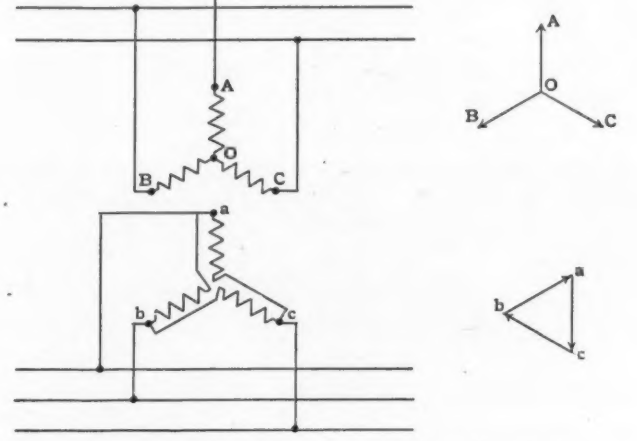


FIG. 4.—Y Δ CONNECTIONS AND VOLTAGE DIAGRAMS.

Where two or more such groups of transformers have to be operated in parallel between the same sets of high-tension and low-tension mains, the ratio of transformation in each group must be made the same, as the primary consideration. It should, however, be noted that equality of phase as well as equality of voltage is essential to parallel operation. Where the method of connection is identical in two groups to be paralleled, i. e., in Δ Δ—Δ Δ, Y Y—Y Y, Δ Y—Δ Y and Y Δ—Y Δ associations, no difficulty in phasing is encountered. It is not generally known, however, that while Δ Δ—Y Y or Δ Y—Y Δ associations will work in parallel; yet

Δ Δ	transformers	will	not	work	in	parallel	with	Δ Y
Δ Δ	"	"	"	"	"	"	"	Y Δ
Y Y	"	"	"	"	"	"	"	Δ Y
Y Y	"	"	"	"	"	"	"	Y Δ

So that out of the ten possible associations above enumerated, of the four types of transformers represented in Figs. 1, 2, 3 and 4, six associations will be capable of operating in parallel, but four will not, owing to phase difficulties.

Since Δ and Y-wound generators are known to work successfully together in parallel, it is sometimes assumed that Δ Δ and Δ Y transformers are also capable of working together in parallel. But in the case of generators, a mechanical shifting of the relative positions of the two windings with relation to their respective magnetic fields is rendered possible as well as necessary, thus permitting of phase adjustment. In the case of Δ Δ and Δ Y transformers in parallel, this shifting between winding and magnetic field is not mechanically possible. Hence, only six out of the ten possible combinations of Δ and Y windings in primary and secondary groups are capable of working together in parallel.

This is an important point to bear in mind, because if a Δ Δ—Δ Δ system of step-down transformers is installed as at *A B C*, *A' B' C'*, in Fig. 5, and an attempt is made to connect a Δ Y transformer with the system, as at *A" B" C"*, in order to establish a secondary neutral point at *O*, the last transformer will refuse to work in parallel with the others, and the secondary mains, *a' a"*, *b' b"*, *c' c"*, will have to be cut. Any attempt to connect the secondary, *a"*, *b"*, *c"*, on the secondary system without cutting, will involve a partial short-circuit between the last transformer, *A"*, *B"*, *C"*, and the other transformers.

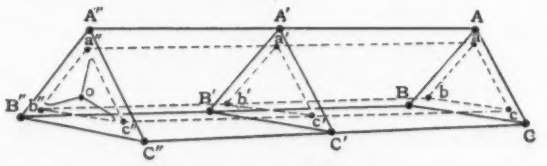


FIG. 5.—UNWORKABLE ASSOCIATION OF Δ Y TRANSFORMER WITH Δ Δ SYSTEM.

If the four cases of failure to co-operate are analyzed, each will be found to present the condition shown in Fig. 6, or an equivalent condition. Here *a b c* represents the vector triangle of e.m.f's on the secondary mains produced by the Δ Δ transformer. The triangle,

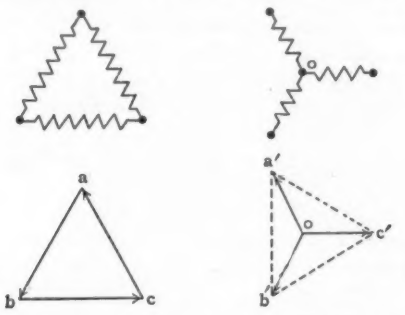


FIG. 6.—VECTOR DIAGRAMS OF Δ AND Y SECONDARIES ASSOCIATED WITH SIMILAR PRIMARY Δ GROUPS.

a′, b′, c′, represents the secondary e.m.f's of a Δ Y transformer operated from the same primary mains as the Δ Δ transformer of *a b c*. In order to place the second set of vectors, *o a′, o b′, o c′*, in their proper topographic position, they must be drawn in parallel to *c a, a b* and *b c*, respectively, as shown. This brings the resultant vector secondary voltages, *a′ b′, b′ c′, c′ a′*, thirty degrees out of phase with the corresponding voltages, *a b, b c* and *c a*, of the first group. If now we attempt to operate the secondary systems in parallel, say by first connecting *b′* with *b*, we obtain the condition of Fig. 7. If any side of the triangle, *a b c*, represents, say, 100 volts, and likewise any side of the triangle, *a′, b′, c′*, then

the voltage between	*a′*	and	*a*	will be	51.76	∠165°	volts
"	"	"	*c′*	"	*a*	"	"	51.76	∠135°	"
"	"	"	*c*	"	*c′*	"	"	51.76	∠105°	"
"	"	"	*c*	"	*a′*	"	"	141.4	∠135°	"

The effect is the same as though two similar bipolar, three-phase generator armatures were placed side by side in the same bipolar magnetic field, and rotated together after being clamped on the shaft at an angle of 30° apart. Either armature alone would be capable of supplying a three-phase system of mains; but the two armatures would not be capable of working in parallel, so long as the 30° phase difference was maintained. If, for example, in Fig. 6, the points *a, b, c*, of the left-hand triangle are connected successively to the point *b′* of the right-hand triangle, the set of cross voltages is a minimum, when, as in Fig. 7, *b′* is connected to *b*. When, as in Fig. 8, *b′* is connected to *c*, the average cross voltage is greater; while if, as in Fig. 9, *b′* is connected to *a*, the set of cross voltages is a maximum.

If we take the most favorable case, that of Fig. 7, with *b′* joined to *b*, and connect *a′* to *a*, *c′* to *c*, in the attempt to parallel the two groups, we

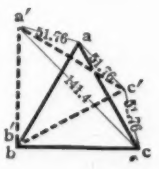


FIG. 7.—SECONDARY VOLTAGE DIAGRAM FOR Δ Δ AND Δ Y ASSOCIATION, *b′* CONNECTED TO *b*.

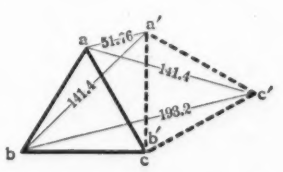


FIG. 8.—SECONDARY VOLTAGE DIAGRAM, *b′* CONNECTED TO *c*.

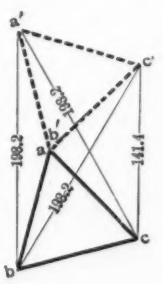


FIG. 9.—SECONDARY VOLTAGE DIAGRAM, *b′* CONNECTED TO *a*.

create two unbalanced e.m.f's of 51.76 volts (for every 100 volts of the secondary system) free to produce enormous circulating currents which may be ten times the full-load currents of the windings, a result that evidently prohibits parallel operation.

The above principles were practically tested by the authors in the following manner: A three-phase, delta-wound generator was motor-driven in such a manner as to produce 100 volts per phase at a frequency of about 60 cycles per second. This delta set of e.m.f's was employed to excite a group of three similar transformers of adjustable transformation ratio. By selecting experimentally the number of secondary turns in each transformer so as to produce approximately 57.74 volts (tapping by inserting an exploring needle into the exposed secondary winding) and connecting the secondaries in Y, as shown in Fig. 10, two sets of three-phase e.m.f's were obtained, as shown in Fig. 7. One of these was the primary set, *a, b, c*, and the other the secondary set, *a′, b′, c′*, each set giving 100 volts per phase. With the vertex, *b′*, of the secondary system, connected to *b*, of the primary system, the arrangement of Fig. 7 was produced. The various voltages, *c c′, c′ a, a a′, a′ c*, were all measured and found to agree with the magnitudes indicated in Fig. 7, within

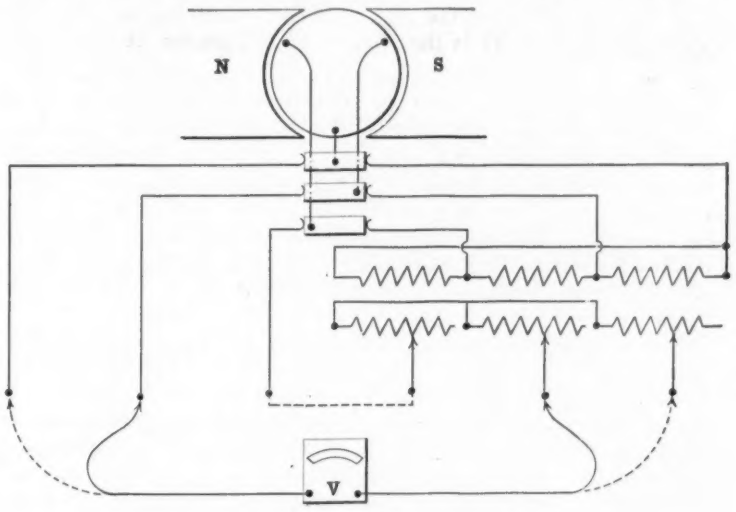


FIG. 10.—CONNECTIONS OF TEST.

the limits of observational errors. Again, with *b′* of the secondary system connected to *c* of the primary system, the arrangement of Fig. 8 was produced with the voltages there indicated. Finally, with *b′* of the secondary system connected to *a* of the primary system, the arrangement of Fig. 9 was produced, with the voltages there indicated.

As Others See Us.

We reprint the following editorial note from a recent issue of our esteemed English contemporary, the *Electrical Engineer*, the note being headed "Wake Up, America": "The editorial remarks which appear in the issue of June 4 of the *Electrical World* of New York on a high-voltage, three-wire system, reminds us of discussions which used to take place in our columns five or six years ago. It seems hardly possible that the electrical industry in America should not have profited more by experience in this country. The editorial remarks are based on a paper read by Mr. Barnes before the convention recently held at Providence, in which the author described a 500-volt, three-wire lighting system. On this subject the editor of the *Electrical World* remarks: 'The use of high voltage—that is, 200 to 250-volt lamps—has come to be somewhat common, particularly in isolated plants, but the development of the idea into a complete three-wire system is much out of the ordinary, and such a system, carrying, as in this case, more than 80,000 connected incandescent lamps, besides motors and arcs, occupies a unique position among central stations.' We fail to see that the position is unique when more than half of the lighting in the United Kingdom is carried out on just such a system. Our contemporary proceeds: 'The most serious consideration in the case of a high-voltage, three-wire system is the possibility of securing efficient and durable incandescent lamps, in the lack of which service must suffer and economy must fall.' This, again, reminds us of the debates in the English press five or six years ago, which debates have been settled by practical experience in favor of the higher voltage. It seems to us that both the central station engineers and the incandescent lamp makers in the States must have been exceedingly indifferent to possible means of improvement for some time." Our contemporary appears to have missed the point of our remarks. The three-wire, 500-volt system as employed in Great Britain has for many years been entirely familiar to American central station engineers, but has met with little favor on this side of the water—which also accounts for the little attention incandescent lamp makers have given to its requirements. Perhaps if in the sentence first quoted "central stations" had been properly qualified by the word "American" our contemporary would not have been misled.

The Commercial Testing of Sheet Steel for Electrical Purposes.

At a recent meeting of the American Society for Testing Material, Mr. C. E. Skinner read an interesting paper on the subject of sheet steel testing for electrical purposes, which we reprint in full below.

In introducing his paper, Mr. Skinner said that at the present time the rate of consumption of sheet steel in the manufacture of electrical apparatus in the United States alone is probably not less than 100,000,000 pounds per year. Assuming that 20 per cent. of this material is subject to the conditions under which the so-called iron loss occurs and that this loss is one and one-half watts per pound, we find we have a total loss of 30,000 kw (40,000 hp), or an amount of power approaching the output of the largest single electrical power station in existence. At the rate of $25 per hp per year, this represents a money value of $1,000,000. This loss manifests itself as heat in the apparatus and, therefore, serves no useful purpose, but forms one of the limitations to the output of the apparatus.

The losses referred to are the hysteresis and eddy-current losses, more commonly combined under the general term "iron loss." This loss occurs in all magnetic material which is subjected to alternating magnetic stresses, the amount of the loss in any given material depending upon a number of conditions which will be referred to later.

In general, the following must be taken into consideration in connection with the testing of sheet steel for electrical purposes:

(1) The losses in different sheet steels vary greatly with the chemical composition and with the physical condition due to the heat treatment and the mechanical working which the steel has received.

(2) In most sheet steel the losses may be reduced by annealing to a relatively small value.

(3) Nearly all steels, when the losses are reduced to a low value by annealing, are subject in a greater or less degree to ageing, or increase in loss, due to the influence of comparatively low temperatures.

(4) The permeability of all steels which may be rolled commercially differs by a comparatively small amount, no matter what their condition with respect to annealing.

(5) In all commercial sheet steels the physical characteristics are well above the service requirements.

The commercial testing of sheet steel for electrical purposes, therefore, resolves itself into

(*a*) Chemical tests to determine the composition of the steel.

(*b*) Electrical tests to determine the losses in the steel after punching, before and after annealing.

(*c*) Electrical tests to determine whether ageing, or increase in the losses, occurs when the steel is subjected to moderate temperatures.

(*d*) Tests for permeability.

(*a*) *Chemical Tests.*—Sheet steel used for electrical purposes is always a very mild steel, the carbon rarely being above 0.15 per cent., the phosphorous (sulphur, silicon and manganese) also usually being kept quite low. The composition may vary over comparatively wide limits and the steel still fulfill the necessary conditions as to quality. One or two complete analyses from each heat and occasional check analyses from the sheet before and after annealing are usually sufficient for the purpose.

(*b*) *Electrical Tests.*—By far the most important tests are those to determine the hysteresis and eddy-current losses, either separately or combined, the amount of these losses showing the electrical quality of the steel.

Hysteresis Loss.—Hysteresis loss may be defined as the work done in reversing the magnetism in the steel, and it may be considered as due to the molecular friction from the reversal of the magnetism, this friction manifesting itself as heat. The amount of hysteresis in a given steel varies with the composition, with the hardness, with the frequency of reversal of magnetism, with the maximum induction at which the steel is worked, and the temperature of the test sample. The hysteresis loss is greater as a rule in hard steels than in soft steels. It varies approximately as the 1.6 power of the induction, and directly as the frequency. It is greater with a flat top or a sine wave of e.m.f. than with a peaked or a saw-toothed wave.

Several instruments have been devised for measuring the hysteresis loss in steel. The Ewing hysteresis meter is probably the one best known and most used. With this instrument, samples weighing only a few ounces are required for the test, the measurements being made at a fixed induction and the instrument calibrated so as to read direct in some convenient unit. Other instruments employing the same general principle or entirely different methods are available for measuring hysteresis loss. A description of these several classes of instruments may be found in the text-books of the day.

Hysteresis measurements are valuable as showing the effects of annealing, but as it is very difficult in practice to separate the hysteresis loss from the eddy-current loss, and as the total loss under working conditions is the point of vital importance to the user of the steel, measurements of hysteresis loss alone become in general of secondary importance.

Eddy-Current Loss.—By eddy-current loss is meant the loss due to the circulation of electric currents in the sheets themselves and between adjacent sheets, due to the steel acting as a conductor in an alternating magnetic field. The eddy-current loss varies inversely as the ohmic resistance, directly as the square of the induction, and decreases as the temperature increases. It is greater in thick sheets than in thin sheets, and is greater as the insulation between adjacent sheets is less. Tests for eddy-current loss alone are difficult to make, and as far as the writer is aware no instrument has been devised for this purpose. An approximation of the amount of eddy-current loss in a given sample can be reached by measuring the total losses at different inductions and assuming that the eddy-current loss varies as the square of the induction and the hysteresis loss as the 1.6 power of the induction. For special investigations the eddy-current loss is sometimes calculated in this way, but commercially such tests are rarely considered.

The measurement of the total losses under working conditions gives the best index of the electrical quality of the steel. As the total loss is made up of the combined hysteresis and eddy-current losses it is subject to all the variations of each as outlined above.

Measurement of Total Losses.—In commercial routine testing as followed out in the sheet steel testing department of the Westinghouse Electric & Manufacturing Company, of which the writer has charge, two separate methods which may designated as the transformer method and the armature method have been found very satisfactory. In both these methods of testing, commercial conditions of operation have been aimed at, in order that the results obtained might be checked with the tests made on similar material in commercial apparatus. The test samples have also been so chosen that they will be available for commercial apparatus later, thus effecting a considerable saving of material where many tests are made.

The transformer method has been so called for the reason that the test sample consists of about ten pounds of punchings of a standard transformer plate, these punchings being built up in the same manner as when used in the transformer. For convenience in handling and winding the test sample a block carrying the coil has been devised, this block being split and the wires of the coil continued between the two parts by means of mercury cups and contacts. By this means samples which are built up or plates which are not split may be used and placed on the testing block with the winding in place in a few seconds. The routine tests on such samples consist in measuring the total losses at a given induction and frequency, by means of a wattmeter. For special tests the induction, frequency, wave form and the pressure on the sample are varied as desired.

This test is used regularly for judging the quality of the lot of steel as received, for judging the quality of the annealing of each furnace load of material, and for determining the ageing on all classes of material. From twenty to fifty tests per day are made on this apparatus by one operator. In making tests of this kind the wave form of the applied voltage must be known and should preferably be a sine wave; correction must be made for the copper loss in the magnetizing coil; correction must be made for the losses in the voltmeter and wattmeter, or these losses must be eliminated in the measurements; the test samples must be at approximately uniform temperature.

The armature method is so called for the reason that the test sample consists of standard armature punchings, which are revolved in a standard form of dynamo field. The measurements are made by means of a spring dynamometer. Photograph of a testing device of this kind is shown in Fig. 1, and a detail drawing of the

dynamometer used for reading the losses is shown in Fig. 2. The general plan of this apparatus is as follows:

A small variable-speed, direct-current motor has a shaft extension on which the sample is mounted. The speed is read in terms of voltage across the terminals of a small magneto which is belted

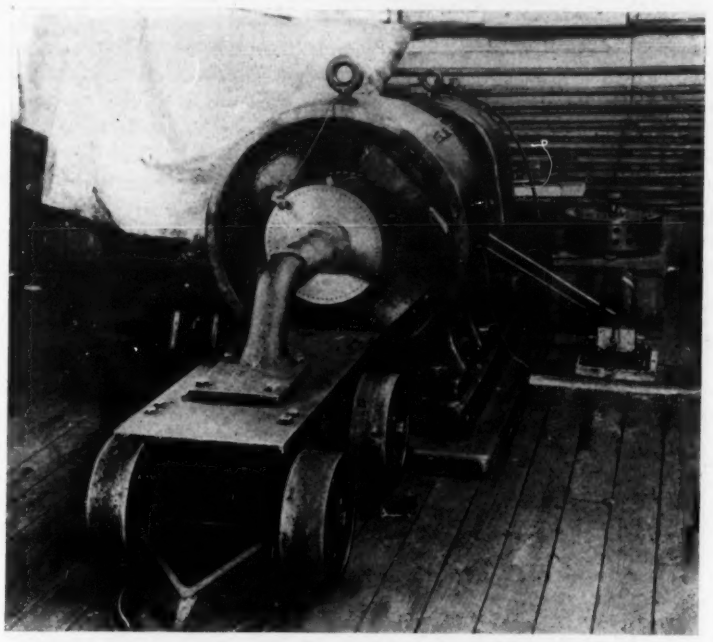


FIG. 1.—ARMATURE METHOD OF TESTING SHEET STEEL.

to the motor shaft and shown to the right in the photograph. The test sample is revolved in a field having specially-wound field coils and adjustable pole pieces. The extension shaft on which the sample is mounted carries a spring dynamometer with a special device for reading the deflection on this dynamometer when the sample is in motion. The sleeve which carries the sample is provided with heavy flanges and is adapted to be placed in an hydraulic press, so that any desired degree of pressure may be reached and maintained on the sample during the test.

The very unique spring dynamometer used in this device was designed by Mr. S. M. Kintner and deserves special notice. As will be seen from Fig. 2, the hollow shaft, *C*, contains a spiral spring,

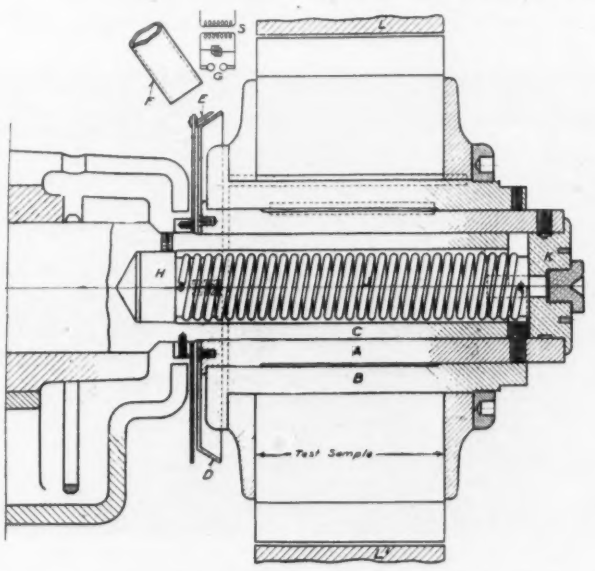


FIG. 2.—DYNAMOMETER FOR MEASURING ARMATURE LOSSES.

J, the inner end, *H*, being rigidly held to the shaft while the outer end is fastened to the sleeve, *A*, on which the sample is mounted. The shaft carries a pointer, *E*, and the sleeve a circular disc, *D*, approximately 8 in. in diameter, graduated on its beveled face in a uniform scale to small divisions. In close proximity to the scale is placed a spark-gap, *G*, which is in series with the secondary of the induction coil, *S*. The primary of the induction coil is connected to a contact device on the motor shaft, the break point being exactly in line with the pointer, *E*. Leyden jars are used across the secondary of the induction coil to cut down the duration of the spark. The scale and the pointer are shielded from the light of the room, and a tube, *F*, is provided for observing the scale and pointer at the exact angular position occupied when the spark passes across the air-gap illuminating the scale and pointer for an instant at each revolution of the shaft. By this means it is perfectly feasible to read to a high degree of accuracy the deflection of the spring when the scale and pointer are both revolving at a speed of from 1,000 to 2,000 r.p.m. The bearing between the sleeve and shaft is nicely ground and well lubricated, so that there is practically no friction whatever when the test sample is in motion. The apparatus is calibrated by measuring the torque on the spring for an observed deflection. The loss in the sample is then measured in terms of torque and speed, reducing this, if necessary, to the ordinary units of watts per pound in the test sample. For comparative work this reduction is not necessary.

By varying the field strength, the air-gap, the form of pole pieces, the speed and the pressure on the sample, tests under a wide range of conditions are obtained. The windage may be measured by taking readings on the dynamometer with no current in the field. In special tests complete curves are taken at varying speeds and field currents. In routine tests only a few points are taken.

For convenience in handling the samples, which, together with the sleeve, weigh approximately 125 pounds, a special truck shown in the foreground, Fig. 1, has been devised, by means of which the sample can be carried about and very quickly placed in position on the testing shaft with a minimum amount of labor.

The above apparatus is used for determining the quality of armature steel as received and the quality of the annealing. It forms a most convenient method of studying the variation in armature losses due to varying conditions, such as pressure, insulation between sheets, variation in induction, variation in form of armature slot, etc. The actual induction may be measured by means of a special coil slipped on the armature punching, the leads of which are brought out to a contact device mounted on the special truck used for carrying the test samples. This device has been in constant use for several months and has been found so satisfactory that it may be confidently recommended to those desiring to make similar tests.

(*c*) *Tests for Ageing.*—It was discovered about ten years ago that when sheet steel is annealed so as to have a low loss and then subjected to a temperature of from 80° C. to 100° C., the loss sometimes increases, in some special cases this increase being as much as 100 per cent in ten days. Fortunately, such cases are rare, and ordinarily the increase is small or there is no change whatever in the loss.

As the ageing depends on the kind of material used and on the heat treatment to which it has been subjected, it becomes very desirable to make regular routine ageing tests on all steel used for electrical purposes. This is all the more necessary as it is practically impossible always to get steel which has been subjected to identical treatments. These ageing tests consist merely in repeating the measurements for total losses at certain definite periods of time after the initial tests, the sample being subjected in the interim to the ageing temperature. Tests after ten days and after thirty days in the ageing oven usually give the necessary data for judging the quality of the material. For purposes of investigation longer tests are frequently necessary, especially when the effect of temperatures lower than the regular ageing temperature is desired. In the tests with which the author is familiar, ageing tests are frequently run for six months or a year, and some special tests have been in progress for approximately ten years.

The transformer samples are usually used for the ageing tests on account of there being less material to handle and the tests being more easily made than with the armature samples.

The ageing oven used for these tests consists of a large wooden box covered on the outside with galvanized iron and lined with asbestos. Steam coils are located at the bottom and ventilators are provided at the top and bottom, so that a slight circulation of air may be secured to equalize the temperature. Steam at 150 to 180 pounds pressure is used for heating. The oven is divided into two parts, one of which runs normally at a temperature of very approximately 95° C. and the other at 60° C. to 65° C. These temperatures are maintained year in and year out, and the oven usually contains from 100 to 200 samples which are undergoing the

ageing test. The temperatures mentioned were selected for the reason that the higher temperature is comparatively easy to maintain and gives comparatively rapid ageing when a material is found which is subject to ageing, and the lower temperature represents very approximately the temperature at which ordinary electrical apparatus will run under normal working conditions.

(*d*) *Permeability Tests.*—As stated earlier in this paper, the permeability of sheet steels used for electrical purposes varies over comparatively small limits, and the exact permeability of a particular sample is ordinarily not of great importance. It is not customary, therefore, to make routine tests for permeability. Occasional tests are advisable, however, and for this purpose a modified permeability meter designed by Messrs. Lamb and Walker is generally used. This instrument, arranged for measuring solid material in the form of round bars, is shown in Fig. 3. For measuring sheet steel the

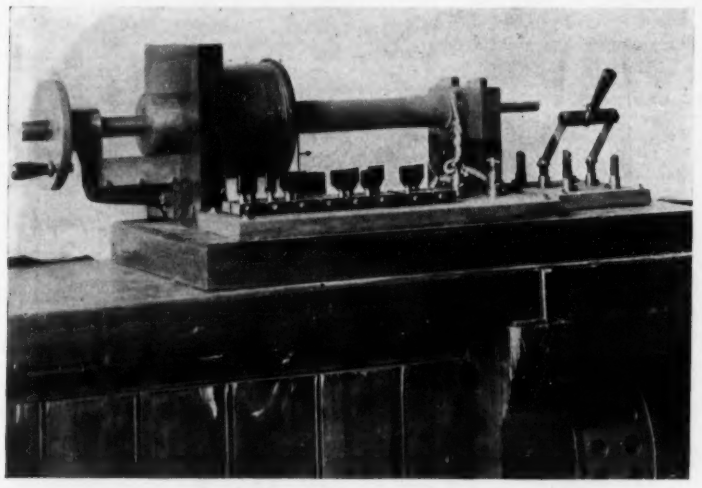


FIG. 3.—LAMB & WALKER PERMEABILITY METER.

form of the coil and sample holders is changed so as to take rectangular sections. Strips of steel to be measured are sheared to the proper dimensions and clamped in blocks made for the purpose, the measurements being made exactly as in the case of solid material. With this instrument a complete permeability curve with hysteresis loop may be taken in a comparatively short time. The accuracy is not as great as with the well-known ballistic method, but it is sufficiently accurate for the purpose and the tests are much easier to make.

The methods of testing described are in daily use and have been found very satisfactory for the purpose for which they are intended. They are not laboratory methods, as the term is usually understood, but they are capable of giving valuable results from an investigation standpoint, as the results obtained may be applied directly to commercial apparatus. It is evident that any work that can be done to reduce the losses in electrical steel and prevent ageing when the losses are reduced, will be of great value to all manufacturers and users of electrical apparatus.

"Radio-Vibrator."

According to a newspaper report recently published, Prof. Herbert C. Carel, of the University of Minnesota, has endorsed an apparatus called a "radio-vibrator," which one Warren F. Bleeker is stated to have perfected in the laboratory of the University. It is stated that the instrument is based on the theory that the elements of the human body, when the body is in perfect health, vibrate in perfect harmony, whereas, when in diseased conditions this normal tone is destroyed. To restore the normal tone, two small circular discs are applied to the affected parts of the body, these discs being connected by two wires to a small nickel-plated box. The box is stated to contain a "mysterious compound of chemicals" concerning which the inventor gives no information. It is claimed that as soon as applied the action of the chemicals within the box is calculated to cause sympathetic normal vibrations within the diseased body, thus restoring the patient to health. We hope that the newspaper is in error in mentioning a University professor as the sponsor of such a scheme.

Electrical Transmission of Photographs.

BY G. WILL.

During several decades a number of methods for reproducing simple pictures, drawings and handwriting electrically at a distance have been proposed and partly carried out, but none of them has led to a result of technical importance. This seems not to be the case with the improved system of Prof. Korn, of Munich, whose success is due principally to the employment of a vacuum tube as an adjustable source of light at the receiving station.

The essential arrangements are well known from previous attempts. Two cylinders, one at the sending and one at the receiving station, run in synchronism. On the former is the picture to be transmitted, preferably on a film, and on the latter is a sensitive photographic film. A fine ray of light concentrated by lens from a

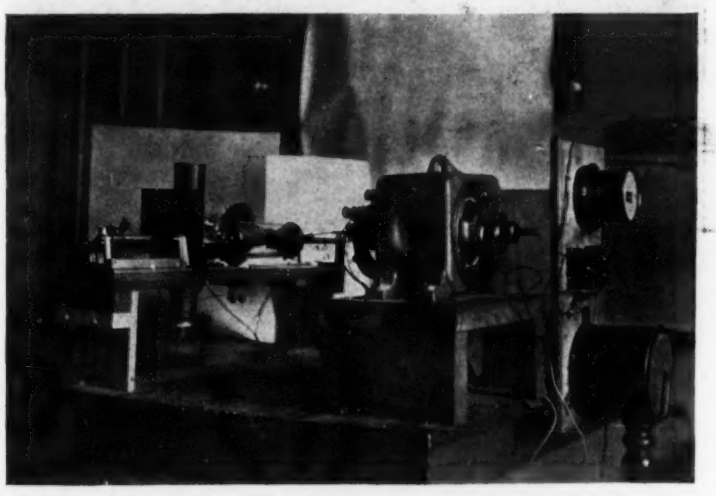


FIG. 1.—TRANSMITTER.

suitably arranged Nernst lamp penetrates the first film and strikes a selenium cell inside of the hollow glass cylinder. The selenium cell is connected in series with an accumulator battery, the line wire and a current indicator at the receiving station. Upon rotation of the hollow cylinder the light ray describes a spiral line of very small pitch on the film, like the stylus of a gramophone. In proportion to the blackening of the film the light ray is weakened more or less, the resistance of the selenium cell raised accordingly and the current in the transmission line shows corresponding reciprocal changes.

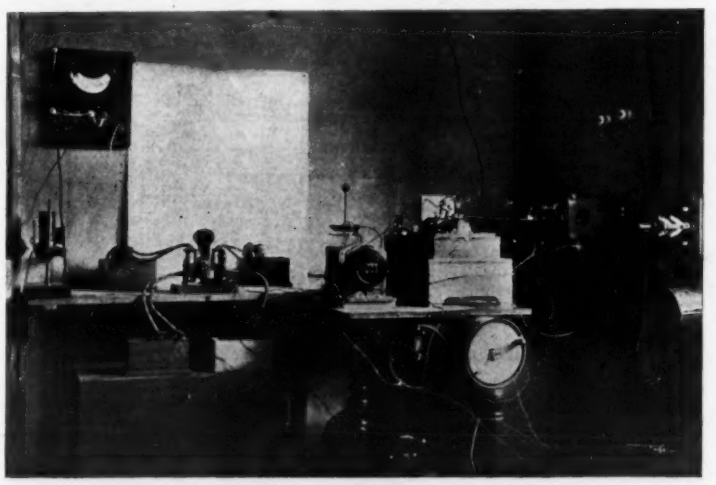


FIG. 2.—RECEIVER.

The current indicator at the receiving station is affected and regulates the local current flowing through the vacuum tube by inserting or cutting out resistances. A fine light ray emanating from the tube describes, exactly as at the sending station, a spiral line on the sensitive photographic film. The power of the light from the tube being regulated by the current indicator according to the blackening of the film at the sending station, a corresponding image will be produced, when the two cylinders run in synchronism.

The source of light for affecting the photographic film at the re-

ceiving station is current derived from a Tesla coil circuit, the value of which is varied automatically with the change in the transmission line current. A galvanometer actuated by the line current operates the sliding arm of a rheostat in the Tesla coil circuit.

The films at both the sending and the receiving stations are mounted upon cylinders driven through worm gearing by means of shunt-wound motors supplied with current from storage batteries. Synchronism of the cylinders is obtained in the following manner: The motors, being shunt machines, have a natural tendency to run at a fairly uniform speed. The source of current being accumulators, the speed of the motors, particularly when running without load, as is approximately true with these machines, can be kept constant within one-quarter of one per cent. without difficulty. Variation of speed resulting from changes of temperature are adjusted according to the indications of a Hartmann frequency indicator by regulating the shunt circuit resistance.

Telautography.—When handwriting or drawings are to be transmitted, they are executed with non-conducting ink on metal foil, which is laid around an insulating cylinder of the same dimensions as the receiving cylinder. A metal pin slides over the metallic surface, from which the current is led through a sliding contact into the line wire. At the receiving station the galvanometer is replaced by a polarized relay, which actuates a high-tension relay connected to the Tesla coil circuit. Whenever the pin of the sender comes to an ink line, the transmitting current is interrupted. The variations thus produced in the continuity of the Tesla coil current cause the formation on the receiving film of dots which compose the writing.

The time required for producing a photograph is at present half an hour. The transmission line may, of course, be used at the same time for telephony. Photographs have been successfully transmitted over a four-fold line between Munich and Nürnberg, the resistance of the complete loop being 3,200 ohms. The time of transmission may be considerably diminished by increasing the deflecting and indicating powers of the galvanometer. Further improvements may be affected by increasing the power of the light (64-cp Nernst lamp), by increasing the surface of the selenium and by a greater concentration of the light rays at the point of penetration.

The time required for the transmission of handwriting or drawings is only one-twentieth of that necessary for pictures. At present 500 words can easily be transmitted in one hour. By operating the high-tension relay directly by the line current an improvement in the operation can be effected.

Standard units of apparatus have not been prepared, but are under construction. When they are completed experiments will be made over longer lines. The photographs in Figs. 1 and 2 show stations composed of available commercial machinery.

Wireless Telegraphy in Barbadoes, W. I.

Mr. A. W. Gray, an electrical engineer, has been working on wireless telegraphy on the Island of Barbadoes, along Fessenden lines. The following is a brief statement of some of his work, published in the local papers:

"In his first test Mr. Gray placed his sending and receiving appliances (stations) 45 ft. apart—the distance mentioned in Prof. Fessenden's report, with 5-ft. verticals consisting of No. 18 wire, at both sending and receiving stations, but instead of a 'coil capable of giving a 3/16-in. spark,' the coil employed when connecting up with a single dry cell gave but an erratic spark between rounded points when separated but the 3/100 part of an inch, and, when the spark-gap was reduced to the 4/100 part of an inch between points (i. e., 1/100 part of the ⅛-in. spark-gap used by Fessenden in his test) a uniform though miniature spark appeared, from which accurate and clear transmission ensued. With other conditions unchanged the 5-ft. vertical wires were then removed from both stations, and the transmission was still continued with distinctness.

"The sending and receiving stations were then placed at either end of the building in which the experiments are being carried on, 90 ft. apart or twice the former distance. The 5-ft. verticals and the 4/100-in. spark-gap were again employed, yet under these critical conditions transmission continued perfect and unimpaired, a remarkable success attained at exactly double the distance over which Prof. Fessenden conducted his remarkable tests. To add further to the creditable conduct of this new invention the vertical wires were again removed, and without them at the doubled distance and with the same spark-gap length transmission was obtained, though its vigor seemed slightly impaired. It may be further remarked that in neither case were transformers employed in connection with the receiving appliances, and the circuits were in no case tuned."

Kingsbridge Power Station of New York City Railway Company.

Believing that the architectural treatment of a large power station should be characterized by artistic simplicity of design, typifying in some measure the dignified purpose of the building, and expressive of a structural strength and solidity in keeping with the idea of power generation, it was attempted to realize something of this ideal in the design of the Kingsbridge station of the New York City Railway Company.

The first condition of simplicity, even more than a due regard for structural economy, so important in commercial enterprises, dictated the use of an ordinary grade of brick for external treatment, giving an obviously solid and homogeneous construction, free from the suggestion of veneer adhering to the use of face brick. The details of the cornices and mouldings throughout are of the simplest character, the inspiration of the design being drawn from the early, or Roman, period of Romanesque art, but freely modified to conform with modern taste and practice. Characteristic of this style are the arcades of deeply voussoired semi-circular arches springing from

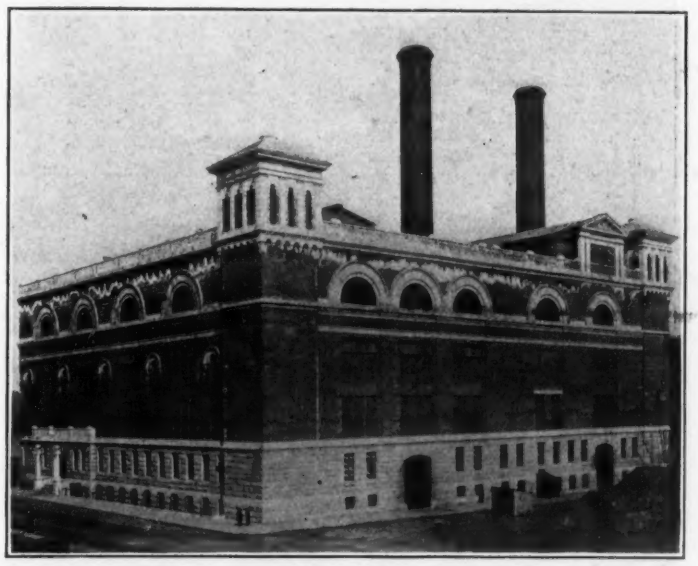


FIG. 1.—EXTERIOR OF POWER STATION.

a cornice belt (a survival of Roman entablature), in this case serving the purpose of a horizontal band coincident with the principal girt of the steel frame. (See Fig. 1.)

While the building is throughout entirely of skeleton steel construction, no adequate exterior expression of this fact is possible in such materials as brick and stone. It was, therefore, determined to design a shell which should be obviously constructive in itself with the substantial appearance appropriate to a large power plant, avoiding the tendency to architectural necromancy so commonly exhibited in steel frame buildings. This it was that dictated the grouping of the windows in large arched openings, separated by broad wall spaces, visibly able to receive and transmit the thrusts of the heavy arches, and caused the introduction of the flanking towers at the abutments of the arcades, which will form the four sides of the completed structure.

The foundations, or sub-structure, of such building are, of necessity, extremely massive and important, and an expression of this fact was sought in the rugged basement of rock-faced granite masonry.

The power units consist of 46-in. and 86-in. x 60-in. Westinghouse-Corliss engines with centrally-located generators, the design being of characteristic type and not involving any special features. Perhaps the most noteworthy feature connected with the engines is the provision for handling them in starting, synchronizing and stopping, by an arrangement which allows the units to run either with vacuum or without, at the will of the engineer.

The generators are of the well-known Westinghouse revolving field type, substantially constructed and operating at 6,600 volts, three-phase, 25 cycles per second. This is one of the first installations where the Westinghouse laminated steel construction was adopted for revolving fields of alternating-current generators. In this construction the entire magnetic circuit of the field is of sheet steel, built up in overlapping layers to form a circuit of low magnetic resistance and likewise a fly-wheel rim of exceptional strength. The wisdom of this selection has been demonstrated by the extent to which this type of construction has since been adopted.

In this plant it was concluded to install barometric jet condensers after due consideration of all of the problems surrounding surface condensers and the possible saving of feed water. The art of applying condensers for large service is one of the most difficult about which to make decisions in large power plants. On the one hand there is the possibility of saving feed water through surface condensers to the extent of $50,000 to $100,000 per annum, with which goes the necessity for maintenance of condensers of this type, together with special provisions for keeping oil out of the condensed water. A study of the problem led to the adoption of centrally-located barometric condensers, four in number, handling sixteen 3,000-kw units, and connected to the engines by 54-in. exhaust pipes, each main receiving the exhaust from four units. Each of these condensers is capable of handling the exhaust steam for about 25,000 hp, thus allowing one condenser as spare or relay.

The design and construction of the steam generating plant appear not to differ materially from many others of like kind. It consists of suitable coal-handling machinery of the belt-conveyor type, supplying generous and well-constructed coal bunkers fitted with fire protection. The ash handling through hopper bottoms and chutes into cars introduces no special features beyond careful detail design. Water-tube boilers are used, in which the heating surface is not made excessive with reference to grate surface; recognizing that the boiler is essentially the size of its fire, mechanical stokers of approved type and usual construction are utilized with the largest grate surface admissible.

All apparatus is adapted for the use of hard or soft coal, as required. The products of combustion pass through generous economizers, with ample draft space, to stacks 200 ft. high, sufficient for normal draft under most conditions of service. This draft is supplemented by mechanical draft between the economizers and stacks, with suitable arrangements for by-passing, so that on short notice the draft may be made equivalent to stacks 400 ft. or more in height. These appliances, carefully arranged with reference to each other as to proportion and detail, and with an ample system for feed water, blow-off, etc., together produce a steam generating plant of high character, and probably as efficient as the present state of the various arts involved will admit. Throughout its design sufficiency and due provision for convenience in operation are noticeable.

The auxiliaries of the station are in the main steam driven. The boiler feed pumps are of the compound, duplex type, the centrifugal pumps for elevating the condensed water for the barometric condensers are driven by compound steam engines, the dry-air pumps are steam-driven, close clearance, fly-wheel type. The stokers are driven by small simple engines, while the mechanical draft fans are operated by plain slide-valve engine of heavy construction, operating at slow speeds and of a comparatively uneconomical type.

The exciters are driven by compound steam engines. The exhaust from all of these auxiliaries is led to feed water heaters, in which it is completely condensed. The feed water, after leaving the preheaters in the main exhaust near the condenser, is raised to 210° in the feed water heaters, fed with the auxiliary exhaust, whence it passes to the economizers for an extra 100° or more, absorbed from waste gases before it enters the boilers. The electrically-driven auxiliaries are the air compressors which operate the pneumatically-operated switches, the 30-in. gate valves in the exhaust branches from the main engines to the main exhaust pipes, the coal and ash conveyors, the freight elevators and the traveling crane.

It will be noted that steam-driven auxiliaries predominate in this station, and while, consistently, some might be equally well handled electrically, the feed water requirements, prior to passing into the economizers, are such as to readily absorb all of the heat yielded by

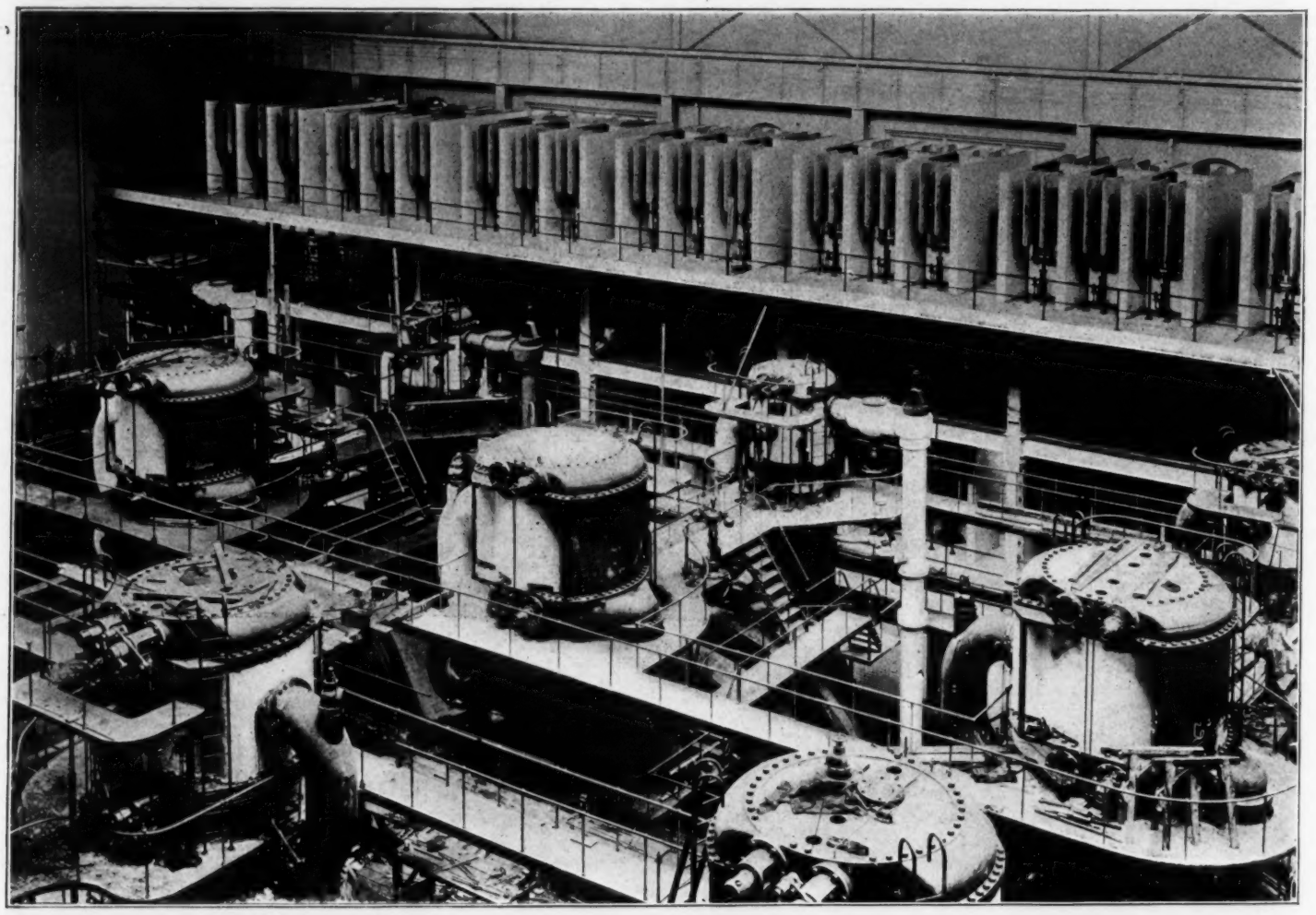


FIG. 2.—SWITCHBOARD GALLERY IN ENGINE ROOM.

the auxiliary exhausts, thus preserving the efficiency of the total heat cycle.

In the design of the switching equipment for this station much care was exercised in the provision of masonry construction and soapstone barriers, without sacrificing anything in accessibility. Each main bus-bar is completely enclosed in a separate masonry compartment and each pole of each individual circuit-breaker is separated from its neighbor by a marble barrier. A characteristic feature of the plant in this particular is the grouping of the feeder circuit-breakers into masonry "cubicles," each "cubicle" forming a distinct unit, having in the interior a group bus connected to the main bus through a group circuit-breaker. The feeders are brought up to their respective circuit-breakers in small groups, so that trouble cannot spread to a serious extent, as has occurred a number of times in other plants.

The switching equipment is arranged on three galleries along one side of the engine room (Fig. 2). The generator circuit-breakers are placed on the lower gallery, the bus structure on the second gallery and the feeder cubicles on the third gallery, thus making the arrangement progressive from generators to feeders without crossing of circuits.

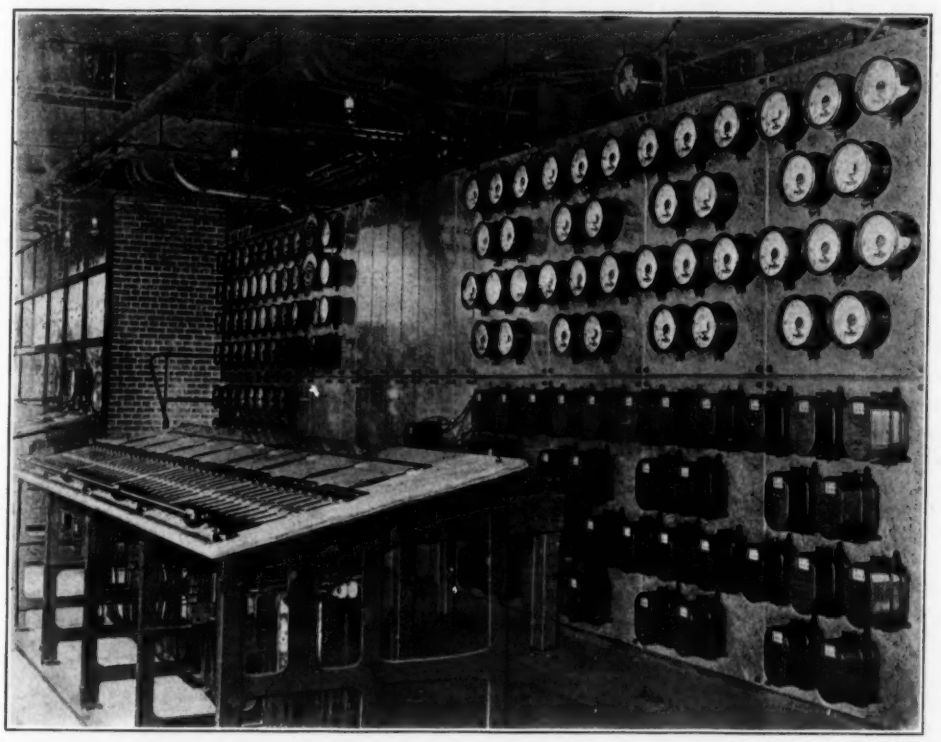


FIG. 3.—CONTROLLING DESK AND INSTRUMENTS.

Air-type circuit-breakers are used for all high-tension circuits, operated from an electro-pneumatic controller system. The operating platform, containing the controlling desks and instruments for the various alternating circuits, is on the second gallery, in a location which is central with reference to the ultimate equipment of power units, and from which there is a comprehensive view of the engine room (Fig. 3). Below this platform, on the second gallery, is the exciter switchboard, containing panels for the control of the exciters and panels for the direct-current feeder circuits for lights and power house auxiliaries; also the field rheostat switchboard and the field resistances. All switching apparatus and all instruments are of standard Westinghouse make.

The portion of the plant now completed, containing eight units, is in full operation, and if, as reported, it has succeeded in thus operating with fewer difficulties in its earlier history than others, it is because of the attention paid to the details of design and construction. It is scarcely too much to say that it has had no troubles whatever, each feature alone and in conjunction with others having worked exactly as predetermined with no necessity for changes. The same condition practically existed throughout the construction, there being no interferences, and, consequently, no changes required.

This power plant exemplifies a well-carried-out and consistent design of a certain date. It would be too much to hope that it would excel plants now projected, which will have the advantage of steam turbines and various new appliances which are now at the command of engineers. It, however, is prepared to take its place and make its record among the four or five large stations of somewhat similar type now built, or under way, in or near the city of New York, and as such it is open to full inspection to those who, through their engineering interests, are entitled to inspect its construction and operation.

New Hotel Plant in Denver.

Among recent installations approaching completion in Denver, the power plant of the Shirley Hotel deserves a visit from engineers passing through the city with a little extra time at their command. The Shirley is a new and handsome building located on the corner of Lincoln and Seventeenth Avenues, with an annex connected with the main building and fronting on Broadway. It represents the most modern practice in hotel work and has a capacity of from 400 to 500 guests. Judged by Eastern standards, it compares favorably with the apartment hotels of Boston, New York and other cities. All the lighting and power service is furnished by the hotel plant, although an emergency connection can easily be made with the supply circuits of the Denver Gas & Electric Company. The main building is six stories in height, built of yellowish cream-colored brick, and is connected with the annex by a covered passageway. The annex is to be opened about July 1.

The power plant is located in the basement of the main building, although the annex is supplied with two 100-hp Heine water tube boilers for heating purposes. Closely allied with the Shirley Hotel in architectural features, location and by physical connection is the new Cheesman Building, which stands near the corner of Broadway and Seventeenth Avenue. This building is also equipped with two 100-hp Heine boilers, but is laid out to enable power to be drawn from the Shirley plant when desired. All these three buildings, constituting a unit group from the architectural standpoint, are arranged to be heated from the main power plant of the Shirley Hotel.

The boiler room of the plant adjoins the engine room and is separated from it by a wall. The equipment is composed of two 100-hp Heine water tube boilers, operating at 100 pounds steam pressure, with natural draft furnace. The usual complement of heaters for steam and hot water uses is placed in this room, with two horizontal steam-driven feed pumps and an oil separator. In the winter season the exhaust steam from the engines is used in the heating system; at other periods when it is not required for this purpose it is discharged into the atmosphere through an exhaust header extending from the end of an exhaust pipe running above the roof as in standard steam practice. To facilitate the inspection of the steam gauges the instruments are mounted on a marble panel in the boiler room directly beneath incandescent lamps, so that the fireman need not strain his eyes to discover the steam pressure which his boilers are carrying—a condition often found in plants which are poorly lighted and which mount their gauges directly upon the boilers. City water is used in the boilers.

The engine room at present contains two direct-connected generating units aggregating 175 kw in normal capacity, a handsome blue Vermont marble switchboard and a 7.5-kw balancing motor-generator set. One of these units is a General Electric six-pole, 75-kw, 250-volt, compound-wound generator, direct-coupled to a horizontal, tandem-compound "Ideal" engine making 270 r.p.m. The cylinders of this engine are 10 in. and 16 in. in diameter, respectively, the stroke being 12 in. The other unit is a General Electric six-pole, 100-kw, 250-volt machine, direct-driven by a horizontal tandem-compound "Ideal" engine, cylinders 12 in. by 20 in. by 14 in., operating at 270 revolutions. The admission pipes are 5 in. and 6 in. in diameter, respectively. Both engines run non-condensing. Although this make of engine is familiar to the engineering world, the adoption

of the compound type for high-speed isolated plant work strikingly illustrates the tendency of the times toward greater economy of operation, even in Colorado, which is well supplied with coal mines. The oiling system in use is particularly interesting. The frame of the engine and the hood over the crank discs form an oil-tight enclosure or casing. There is a depression in the frame under the crank to provide a reservoir for the oil, into which the crank discs dip. Oil adheres to the discs, and in the course of revolution is thrown off by centrifugal force, being cast back upon the crosshead and thrown up into receptacles in the hood above the discs, from which point it flows in streams through channels to the main bearings, crank pin and eccentric. From these distributing points the oil returns by gravity to the reservoir, to be used over again and again. No special oil mechanism whatever is employed, lubrication being effected by the forces already at play in the engine. The low-pressure cylinder is attached directly to the engine frame and is equipped with a balanced flat valve, which comes in a direct central line with the eccentric rod and the high-pressure valve. The two cylinders are coupled close with a uniting head between, and the exhaust from the high-pressure cylinder discharges directly into the low-pressure steam chest. The maintenance problem is thus greatly simplified.

The switchboard is 13 ft. 4 in. long and 7 ft. 6 in. high. It is made up of five panels, each having a sub-base 30 in. high. The first panel is given up to the generators and carries, for each machine, a 500-amperemeter, triple-pole, single-throw switch, a field rheostat handle and voltmeter plug. The sub-base carries a 300-amp., 250-volt Thomson recording wattmeter for each generator, and a Thomson astatic voltmeter reading up to 350 volts is supported at the left of the panel on an extension bracket. The second panel controls the balancing set and contains two 75-amperemeters, two field rheostats and three single-pole, single-throw knife switches. The sub-base carries a motor-starting rheostat. The last three panels carry triple and double-pole switches controlling the various power and lighting feeders, which transmit current to the three buildings. The two largest of these switches have a capacity of 500 amp. each, and are double-throw to enable the emergency connection to be made. All fuses are mounted upon the back of the switchboard and are accessible by a closed-in passageway in the wall. All the switches are built for 250 volts. The switchboard is lighted by seven 220-volt lamps, the first two panels having two lamps each and the last three one each.

Distribution is carried out on the three-wire system, current being used for electric lighting in the various rooms, offices and store closets of the different buildings, for operating passenger and freight elevators, ventilating fans and other machinery. An interesting apparatus is installed in the hotel kitchen for washing dishes by electric power. It consists of a Garia-Cochrane washer belt-driven by a 2-hp, 230-volt Lundell motor making 1,130 r.p.m. Dishes are set on racks which slide into a housing, after which the motor drives a pump which drenches them with soft soap suds for three or four minutes. The attendant then turns a valve which admits scalding water, and the dishes are withdrawn, after being thoroughly rinsed. They are dried by evaporation almost immediately. The machine will wash about 3,000 dishes an hour, or enough to supply the wants of 200 persons in the hotel dining-room.

The balancing set consists of two 7.5-kw, 125-volt, four-pole General Electric machines mounted on a common base and coupled together on the same shaft. Their normal speed is 850 r.p.m. One machine is driven by the other as a generator or motor, according as the load overbalances on one side or the other of the three-wire system. Although some fluctuation can be noted in the 220-volt lamps (the system being operated at this voltage instead of 250), when the elevators start, the brilliancy is not affected enough to disturb the casual observer, and the effect is barely noticeable on the 125-volt lamps scattered through the house. The incandescent lighting is most artistic throughout the establishment.

Electricity on Steam Roads.

President Mellen is credited with the statement that within ten years a speed of 75 miles an hour can be made by the cars of the New York, New Haven & Hartford Railroad, between New Haven and New York, by means of electricity. President Mellen is wide-awake and a close observer of events.

Meeting of the Indiana Mutual Telephone Association.

The annual convention of the Indiana Independent Mutual Telephone Association was held at Lafayette June 28 and 29. Besides the guests from Illinois and Kentucky there were about 200 active and associate members present. The organization was formed seven years ago for the purpose of the promotion of the independent telephone business in Indiana.

The forenoon of the first day was given up to registration, distribution of badges, inspecting the exhibits of the supply houses and a parade of the downtown streets. The headquarters were at the Lahr House, which the supply house representatives converted into a temporary storehouse, displaying elaborate exhibits of their apparatus and equipments.

The first session was called to order by President Rome C. Stephenson, of Rochester, who introduced Mayor R. B. Sample. The Mayor said the city of Lafayette welcomed the telephone men and felt honored by their presence. He said Lafayette had become quite an independent telephone center and no class was doing more for the convenience and happiness of the people than the telephone men. The Mayor concluded by saying that the city was free and the keys in the well. President Stephenson, on behalf of the association, replied to the Mayor's address and said the convention appreciated the Mayor's hearty and courteous welcome. He said that Indiana had become the garden spot of the independent work; that great and powerful opposition had been overcome. We hold these meetings annually, not for the purpose of devising plans to decrease the rates, but for the coming together to exchange ideas and experiences for the betterment of the service.

The first paper was read by Prof. J. C. Kelsey, who is at the head of the telephonic engineering department of Purdue University. The subject assigned him was, "How to Make an Independent Telephone Man." The gist of Mr. Kelsey's paper was that there is a present necessity of a thorough technical education to make a successful telephone man. No one expects a business man to turn over $50,000 to a man with no experience and tell him to go out and make the most of it. And yet that is exactly what many of the managers of the independent companies over the country do. Purdue University, he said, affords excellent facilities for the training of young men for telephone work. Every feature and requirement of the business, from installation to operation, is gone over thoroughly and the young student on leaving the school is competent to construct any terminal or take care of any branch of the telephone business.

In the discussion of Mr. Kelsey's paper, President Stephenson said he could affirm everything Mr. Kelsey said. He referred to the successful installation of an exchange for him by a Purdue student.

"The Part Played by the Press in the Development of the Independent Field" was the subject of a paper read by Mr. Henry A. Barnhart, of Rochester. He said that advertising had grown from year to year until the success of any undertaking which depends upon public support must depend upon judicious advertising for its basis. In this busy age people are in the habit of going directly to the advertising columns of papers to find what they need and where to get it. But you ask how a telephone company shall advertise and what good will it do? In the telephone manufacturing industry there are names of manufacturers and apparatus which have become household words because we see and read most of their advertisements and know the merits of their products, and certainly the importance of making the general public familiar with the telephone service you give must be equally apparent. The wise telephone manager can well afford to cultivate the good will of the local press. He can do this by giving the newspapers all the favors he can without sacrificing business interests, and they will return publicity favors to freely recompense him for the good will "bread cast upon the waters." Direct advertising or personal mention is an effective method. For instance, if Mrs. Bedott, Mrs. Shiner and Mrs. Castrong have telephones put in their residences, see to it that the local news columns of your home paper tell it to the world and you will set a dozen neighboring women in a frame of mind to persuade their husbands that they should have telephones as well, and your orders for telephones will increase.

If a business man sees it announced that his competitor has a telephone put in, a ginger-like sensation will come over him and you get another order for a business telephone. It is also profitable to occasionally hand a coupon book to your local editor to be used

within your field of operation for news gathering. You will lose nothing, for it will frequently be mentioned in the papers that this and that important news article came by telephone. That keeps the public advised that your toll lines reach surrounding points and your toll receipts will increase as a result. The two most important requisites in the telephone business are, first, to give a meritorious service; and second, never halt in judicious advertising endeavor.

Mr. A. L. Têtu, general manager of the Home Telephone Company, of Louisville, Ky., was introduced and made a strong plea for a more humane and generous treatment of the telephone girl. He said the most important thing in making a successful telephone company is the operator. The telephone girl can make you or she can break you. We must have good and well-drilled operators. A telephone man must have regard for the telephone girl—the barometer of his success. The girl is not there for pastime or pleasure, but because she has to work. Any subscriber given to abusing the telephone girl from the other end of the line for no sufficient cause is a brute. And a telephone manager who will not rip out the telephone of the offensive subscriber does not merit success. "If I do no more than aid the crusade for a better, kinder treatment of the telephone girl, I will consider my visit to your convention well worth the while. Let us get together and make the life of the telephone girl pleasanter," he said, in conclusion.

Mr. Samuel G. McMeen, of Chicago, was called to the platform and made a few interesting remarks. He is a recent convert to independent telephony, and three cheers were given for him as being one of the most valuable acquisitions to that cause.

The last session of the convention was held Wednesday afternoon. John F. McHugh, of Lafayette, read a paper on "An Attorney's Impressions of the Independent Telephone Field." Mr. McHugh said that among an attorney's first impressions was the fact that the independent telephone has had to fight for its life inch by inch against one of the strongest monopolies of modern times, and has made its fight with calmness, with loyalty to the public and with a fixed determination to win. After many hard battles we have come out sound and with a firm determination and purpose to continue the good work and to constantly merit not only the good will, but the approbation of the public. Other impressions are that the operation costs less as the years progress and the public realizes the benefits that accrue to it by virtue of the independent service. As time develops our usefulness, our sincere desire to serve the public and the benefits that accrue to it, the opposition does not count for much. The non-selfish attitude of the independents with reference to the public is gratifying. They are willing to serve the public and do not want all the people have for such service. Rates are low, service good, the public interest considered, courtesy always extended. We have to meet unfair competition. The monopoly here, there, everywhere, in the hope of exterminating the independent, and thus stifle competition, has lowered the rate below ours, but with no honest purpose to serve the public, rather for the sole purpose to crush its young competitor and then again fasten the coil of high rates on the people. Lastly, an attorney's impression of the independent field is that it is one of the great benefits in aid of modern progress. A very few years ago the telephone was a luxury; prices and rentals were high and the monopoly did nothing to serve the great masses of the people. To-day the telephone, thanks to the independents, is a necessity, and every little home as well as every palace, every village and hamlet as well as the cities, enjoy its usefulness.

Mr. H. B. Sale, of the Indianapolis Telephone Company, contributed a paper on the "Relation of the Purchasing Agent to a Successful Telephone Company," which paper was read by C. S. Norton, of the New Long-Distance Telephone Company, of Indianapolis. It was an informal talk from an expert to men who know every feature of the telephone business. Mr. Sale made a plea for more harmonious co-operation and advocated uniformity of rules and apparatus—a standardization of the independent field. The paper was discussed by Mr. Throward, of South Bend, and Mr. Wright, of Elkhart. Mr. Throward said the way to have co-operation was to cooperate. He said that the independent toll line systems were not wholly void of selfishness. To illustrate, we have a toll line from South Bend to Logansport, and Indianapolis has a toll line to Logansport, and yet the people of South Bend do not talk with Indianapolis. A committee was appointed to investigate the matter and effect toll line service wherever possible.

The following officers were elected for the ensuing year: President, Theodore Throward, South Bend; vice-president, C. A. Reeves, of Plymouth; secretary-treasurer, J. K. Johnson, of Elkhart.

The Hotel Lahr was handsomely decorated and a dozen parlors were converted into exhibition rooms. There were attractive displays of apparatus.

The visit to Purdue University and the inspection of the mechanical and electrical departments under the escort of Prof. Kelsey was a most enjoyable and interesting feature of the convention.

Mr. Walter Doolittle, manager of the Sterling Electric Company, was titled the "ubiquitous, indefatigable and cordial Mr. Doolittle," and much of the success and pleasure of the convention was due to his efforts.

Electric Traction on the Trans-Siberian Railroad.

In a paper read before the third Russian Electrotechnical Convention at St. Petersburg, Count A. F. Lubienski brought forward some facts concerning the desirability of adopting electric traction on the Trans-Siberian Railroad. The author stated that in the near future it will be necessary to operate 40 to 50 trains per day, due to the large number of emigrants to be carried and to the freight to be handled. The speed of the trains under present conditions is limited by light rails, by the bad profile of the road and by lack of water. The last-named difficulty can be overcome by the construction of more suitable ducts or by using more powerful locomotives with tenders of larger capacity.

The elimination of the effect of the light rails and bad profile of the road, however, would necessitate an excessive expenditure of money and consume considerable time. It would prove much more economical to establish electric traction on some sections of the railroad. In this case the construction of the line would remain unchanged and high speeds could be attained even on sharp curves, the axles of electric locomotives being independent of each other, while the grades could be climbed without difficulty by increasing the number of axles. In the case of electric traction the question of water supply is not of great concern, for the central stations could be established in the neighborhood of large lakes or rivers, at a distance of 75 to 150 miles from each other, and current could be sent at 75 to 100 kilovolts in both directions. In spite of the difficulties in obtaining electric materials and supplies and the necessity for a staff of technical men, which could hardly be found in Russia, it would be easier to adopt electric traction than to undertake the rebuilding of the whole line.

At the conclusion of his paper the author proposed the following questions to the members of the convention: (1) Would it be possible, in the opinion of mechanical and electrical engineers, to change the existing steam traction on the Trans-Siberian Railroad into electric traction, taking into special consideration local conditions, particularly as to climate? (2) To establish plans and specifications for providing a sufficient quantity of water, especially in the western section. (3) To substitute heavy for light rails throughout the whole length of the line, and to furnish the railroad with sufficient rolling material to operate 50 trains at a sufficient rate of speed, or (4) to establish similar plans and specifications, with all details, for electric traction, in order to draw comparison between the two systems.

ELECTRIC TRACTION IN THE CAUCASUS.

G. O. Graftio, in a paper read before the third Russian Electrotechnical Convention, gives some economical data about electric traction on the railway lines of the Caucasus in Russia. Owing to the fact that steeper grades can be allowed without diminishing the capacity of the railway, electric traction proves itself particularly suitable for mountainous regions where waterfalls or rapids can always be found. The Caucasus, therefore, present conditions particularly well adapted for carrying out such work. The considerable amount of "white coal," to use the French expression, will furnish the motive uower at a very low rate. The Toapse, Chakhe, Mzimiou, Psoou, Bzib and Kodor Rivers, which drain an area of 300 to 2,000 sq. km., and whose output is 80 cu. meters per second, give a good illustration of these conditions.

In comparing the cost of electric with steam traction for a 220-km. line on the shores of the Black Sea, the author bases his calculations upon data taken from the Lekko-Kiavenna electric railway and the Uladicaukasus steam road. The approximate cost of a

3,000-kw central station on the River Psheesh, and of the sub-stations with electrical equipment, including the high-tension line (30,000-volt, three-phase), would exceed the cost of the steam road by a sum of $5,000,000. On the assumption of an average traffic in passengers and freight, the annual expense would be less in the case of electric traction, independent of any consideration of the total absence of expenditure in water ducts, etc., which amounts to the sum of $1,000,000. The final result is that there is a profit of $4,000 per km. in the case of electric traction. Besides, the steep grades give a considerable economy in the construction of the electric line. The above considerations were stated to point to the economical success of electric traction and the author was led to propose to the convention that efforts be made to obtain from the Ministers of Finance and of Ways and Communications authority to start the work at once. A special technical commission was created to further study the subject.

Recent Electrochemical Developments.

ELECTRIC STEEL FURNACE.

We have recently referred tn these columns to a patent of C. P. E. Schneider, of Le Creusot, France, for a modification of the induction type of furnace. The ring which forms the single secondary winding of a transformer consists of a tube of small diameter, containing the molten metal and communicating at both ends with a melting pot or crucible of larger dimensions, which contains the greater part of the molten metal. With this form of furnace it is always necessary to fuse the metal outside of the furnace and introduce it into the melting pot. This occasions a loss of heat in the preliminary melting furnace and a loss of time in the transfer.

The same inventor has now patented a furnace which is a combination of the induction furnace with an ordinary electric arc furnace, the latter serving merely for melting the metal bath in the large crucible of the induction furnace itself, so that the use of an external melting furnace is obviated. On the other hand, the chief advantage of the induction furnace, namely, that there are no electrodes from which impurities could be brought into the molten mass, is evidently lost by this arrangement.

A NEW ALUMINUM PROCESS.

A patent granted on June 29 to Mr. Gustave Gin, of Paris, France, is interesting, since it refers to a process starting from bauxite as raw material and producing metallic aluminum. The process may be divided into three phases, the first being the preparation of the electrolyte, the second the electrolytic process and the third the recuperation of the reagents.

The electrolyte is a mixture of aluminum fluoride and sodium sulphide, which are prepared in the following way: Dried, but not calcined ordinary bauxite is pulverized and treated with a solution of hydrofluoric acid. This brings about the formation of aluminum and iron fluorides and of aluminum fluosilicate and fluotitanate. The iron and the silicic and titanic acids are then eliminated and there remains aluminum fluoride, which is the principal element of the electrolyte. The other constituent of the electrolyte, sodium sulphide, is obtained by the reduction of anhydrous sodium sulphate by means of carbon.

During the electrolysis of the mixture of aluminum fluoride and sodium sulphide the following reactions take place: As soon as the mixture begins to melt the constituents react upon each other, thus causing the formation of sodium fluoride and aluminum sulphide. The sulpho-aluminate, the heat of formation of which is much lower than that of the fluo-aluminate, is alone decomposed by the current. Aluminum is obtained at the cathode and sulphur at the anode, while the sodium sulphide reacts upon the fluo-aluminate to furnish a new quantity of aluminum sulphide, which is subsequently electrolyzed.

The recuperation of the reagents is made as follows: The sulphur, which is disengaged at the anodes, is burned in contact with air, and the mixture of air and sulphurous anhydride, which is the result, is transformed into sulphuric acid either in lead chambers or by the contact process. With the concentrated sulphuric acid the inventor treats the sodium fluoride forming the residue of the electrolytic action, thus obtaining hydrofluoric acid and sodium sulphate, both of which are used, as mentioned above, for the preparation of the aluminum fluoride and the sodium sulphide respectively.

The scheme is to consume only bauxite and carbon, while the other materials used are indefinitely recovered and recuperated. In practice, however, there are losses by slow volatilization of sodium fluoride and the carrying down of intermediate bodies with the precipitates, and these losses must be compensated for. The inventor claims as an important advantage that his process suppresses the delicate and expensive manufacture of pure alumina from bauxite and replaces it by the easy preparation of aluminum fluoride. The counter e.m.f. of polarization of the electrolyte is stated to be not above one volt, and his electrolyte is said to be easily handled and to satisfy all requirements of density, fusibility and conductivity.

BATTERY INVENTION.

J. W. Madigan patents a "perforated horizontally-corrugated plate having the perforations extending through the corrugations and finished free from projecting lips around the perforations, a solid reinforcing bounding rim cast around the plate and burned to the edge thereof, and active material extending from bounding rim to bounding rim all over the plate and locked to the plate through the perforations and covering the entire surface on each side of the plate within the rim."

H. C. Porter casts the plate in form of a casing with a plurality of internal longitudinal ribs, which are integral with both walls of the casing, so that the casing is divided into a plurality of pockets. These pockets are filled with active material in paste-like condition. The sides of the casing are, of course, perforated. The same inventor in another patent describes another construction of a plate, "comprising a grid provided at one end with a shoe of non-corrosive material and enclosed within a metallic sheath."

J. P. Clare patents a "dry" storage battery in which he uses the husk or coating of cocoanut for providing a porous structure which is saturated with the electrolyte.

P. J. Kamperdyk patents details of construction of carbon electrodes for primary batteries.

MISCELLANEOUS.

A patent granted to W. J. Schweitzer refers to apparatus for treating sewage by electrolytic means. The sewage first passes into a receiving tank with baffle walls and screens to separate the heavy solid and non-putrescent matter from the liquid and semi-liquid matter. The heavy matter is conducted to a settling and mixing chamber while the liquid and semi-liquid matter passes through a sterilizing chamber, where it undergoes electrolytic action and is deodorized and disinfected. The patent refers to the combination of the various apparatus used for this purpose.

Two patents were granted to G. D. Burton for extracting essential oil from bark or other vegetable matter. The vegetable matter is placed in porous bags and immersed in a menstruum through which an electric current is passed which heats the liquid and causes the extraction of the oils.

New Telephone Patents.

CALL METERS.

The question of call meters is as yet far from being definitely settled, there being quite a number of different, yet commendable ideas, upon the subject. Some feel that the whole act of registering calls should be carried out at the central office; some that the subscriber should perform the operation, all apparatus being confined to his premises; and there is another class of register whereby the operation or the apparatus or both is distributed in some manner between the central office and subscriber.

Of this latter class is a system of registering calls, the apparatus for which is the subject of a patent granted to J. W. Lattig, of West Bethlehem, Pa., and C. L. Goodrum, of Philadelphia. With this system the subscriber does the actual registering of the call, the counter being located at his instrument. He is, however, constrained to make his count at the will of the operator, as she controls his counter through a lock. The operation is as follows: The desired party being waiting and the caller so informed, may push his button. If the operator desires his count to be made at this time, she through electrical means unlocks the push button. The register counts one, the dials being in view of the subscriber, and at the same time an audible signal is transmitted to the operator. The inventors have assigned their patent to the Eastern Telephone Manufacturing Company, of Westchester, Pa.

Still another counting device is that described in a re-issued patent

to C. E. Scribner. In this system all apparatus and operation are confined to the central office, the patent dealing with an automatic counter, in which one call is registered for each connection, upon the response of the desired station. Mr. Scribner has assigned this patent to the Western Electric Company.

NEW LAMP JACK.

William Kaisling, of Chicago, has recently patented a lamp jack in which the strapping between the individual sockets of the step is obviated. To this end he makes a single terminal strip suffice as one terminal in all the sockets, this strip running the whole length of the socket strip and being profusely shaped and formed to contact with all the lamps. The Stromberg-Carlson Company has been assigned this patent.

TRANSMITTERS.

A transmitter, primarily designed for use in connection with submarine signals, is shown in Fig. 1. This transmitter is a rather novel

FIG. 1.—MUNDY AND SMITH TRANSMITTER.

embodiment of the multiple circuit microphone, in the usual form of the granular button. The opposed faces of the electrodes, of carbon, are, as will be seen, corrugated, and within the cylindrical chambers formed between opposite corrugations, small pieces of incandescent lamp filament of suitable calibre are placed. This whole microphonic system is then mounted in a chamber whose ends, supporting the electrodes, are of a resilient material. E. J. Mundy, of Boston, and A. E. Smith, of Waltham, are the joint inventors, they having assigned their rights to the Submarine Signal Company.

A combined receiver and transmitter has been patented by J. G. Holmström, of Sweden. A single casing carries both diaphragms, the receiver diaphragm and ear cap forming one end of the chamber, while the transmitter and angular mouthpiece form the other end. The trouble usually found with such an instrument is the mutual effect of the two diaphragms, this introducing a characteristic self-excited howling or humming. To overcome this the inventor separates the transmitter and receiver parts by a non-elastic cushion and he mounts the diaphragms upon non-elastic cushions.

A NEW CENTRAL SIGNALING SYSTEM.

Central signaling systems heretofore put out have required not a few of the features of the much superior common battery system,

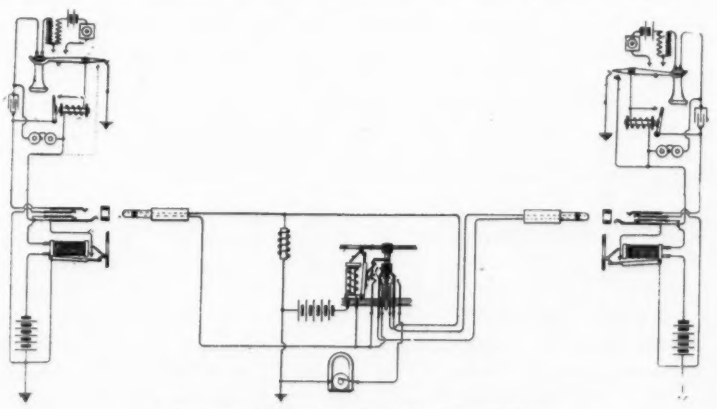


FIG. 2.—SCRIBNER SIGNALING SYSTEM.

and they have, therefore, largely given place before this latter. There now appears a much simpler central signaling system which can probably be successfully operated from primary batteries, as with this system momentary impulses of current serve to properly set the signals. There may be some field for such a system. The circuit is shown in Fig. 2, from which the operation may be readily traced, all signals being primarily controlled by the momentary ground contact made during the motion of the switch hooks from upper to lower position and vice versa. Upon the first contact with this ground the line signal operates and electrically locks itself until the operator responds to cut it out. The relay at the calling station, the left-hand one, which responded to the momentary ground, was short-circuited by the locking contact and released its armature. The connection being completed and the ringing key depressed and locked in this position, the right-hand station answers. As his momentary ground comes on, the cord signal and his relay are energized. This trips the ringing key, which returning breaks the circuit long enough for the station relay to release its armature. The operation of the clearing-out signal is now evident. C. E. Scribner, of Chicago, is the patentee of this system, the Western Electric Company having been assigned the patent.

AUTOMATIC EXCHANGE.

An automatic exchange apparatus guaranteeing secrecy has been invented and patented by Messrs. F. A. Lundquist, John Erickson and J. C. Erickson, all of Chicago. In this system, besides the general selective apparatus and circuits, there is arranged a system of private circuits connecting each switch with every other. Now, when *A* has selected and called *B* he informs him that he is *A* and will talk privately. *A* and *B* then both manipulate their calling apparatus to select their common private wire exclusive of all other stations. The manipulation of the apparatus is akin to an already existing system of the Globe Automatic Telephone Company, to whom the patent has been assigned.

SELECTIVE SIGNALING SYSTEM.

Garrison Babcock, of Chicago, has patented a step-by-step signaling system, especially designed with reference to avoiding grounds and other unbalancing influences. Selection is accomplished by means of an automatic selecting device, which can be set by the operator and allowed to send out the proper series of impulses. Further features embrace an automatic synchronizing of all selectors and motors at the end of each connection, and facility for simultaneously selecting any number of stations upon the same line. The Stromberg-Carlson Company has obtained this patent by assignment.

CURRENT NEWS AND NOTES.

ELECTRICAL MILKING OF COWS.—By means of an apparatus recently invented in Germany electricity is now being utilized for milking cows. In describing the device, United States Consular Agent Warner, at Gera, says that the milk is transferred to the receiving vessel by means of a rubber tube from which the air is exhausted by electricity, this tube being attached to rubber hoods which cover the animal's udder. This method of milking, he adds, insures absolute cleanliness of the product.

THE TELEPHONE IN ENGLAND.—The English Government has concluded not to exercise its option of purchasing the business of the National Telephone Company, which conducts the independent service throughout Great Britain. Under the terms of the National Company's license the government could give six months' notice of purchase prior to December 31, 1904. The company's license expires by limitation in 1911, and as is well known the government does a large telephone business of its own through the post-office. The company earned $9,179,215 in 1903 and paid $1,489,165 in dividends.

NOVELTIES IN EXTERIOR ILLUMINATION.—The remodeling of the new Curtis Theatre in Denver is to include a new feature in the way of a row of electric lights surrounding the entire block in which the theatre stands at Seventeenth, Curtis and Champa Streets. Architect F. E. Esbrooke has included in his designs for remodeling the theatre a plan for a $5,000 electric light plant. Thousands of incandescent lamps will be placed along the front of the business houses in the block, the estimated expense being $10,000 for the entire lighting scheme. Electric lights are widely used in Denver for advertising purposes, and several novel designs in the way of an automobile sign for a garage, shaped like a touring car, and an illuminated terrestrial globe which revolves in the interests of a prominent moving house with the words, "The world moves. So does Turner!" have been recently placed in operation. Large clusters and rows of colored lamps are also used by the Denver City Tramway Company for decorating its rented car in the evening.

HONORS TO KELVIN.—A cable dispatch from London of July 4 says: "The American Society celebrated Independence Day at the Hotel Cecil, where the members entertained the constructive brains of Great Britain, including Lord Kelvin, Chief Naval Constructor Sir William White, Sir John Barry and a number of other engineers, and also Prof. Sir James Dewar and Capt. Mahan. The principal speech was delivered by Ambassador Choate, who dwelt upon the links great engineers had forged in binding Great Britain and the United States, especially mentioning Lord Kelvin, who, he said, was almost the only survivor of the enterprising, skillful companionship which laid the first transatlantic cable in 1857."

OPENING NEW YORK SUBWAY.—September 1 as the opening day for the Rapid Transit Subway has been informally fixed at a conference between Mr. August Belmont and Mayor McClellan. The Mayor requested Mr. Belmont to name a specific time for the completion of the subway work and the running of passenger trains. Mr. Belmont said that the experimental trains would be running by the first week in August, and that if no labor troubles were started the running of full trains would be begun by September 1. When the first passenger trains are run they will proceed to One Hundred and Twenty-fifth Street only, and it will be winter before trains will be run straight through to Fort George on the west side and into the Bronx on the east side. The opening will be attended with some kind of celebration.

STARTING RESISTANCE FOR INDUCTION MOTORS.—Two patents issued June 28, 1904, to G. B. Dusinberre, relate to methods for varying the resistance included in the secondary circuit of induction motors under starting conditions. According to one method, the inventor proposes to mount the extra resistance in the form of a helix concentric with the shaft of the rotor, and to provide for varying the effective length included in the secondary circuit by means of a contact device movable longitudinally upon the shaft. According to the second method, the variation in resistance is to be accomplished automatically, and for this purpose the auxiliary resistance is assembled in spiral form and mounted so as to rotate with the motor shaft, which shaft also carries a contact device operated by centrifugal force, whereby the amount of resistance included in the secondary circuit is decreased with increase of speed.

SELF-STARTING, SINGLE-PHASE MOTOR.—Means for rendering a motor self-starting on single-phase circuits, without the use of a commutator or split-phase devices, are disclosed in a patent granted to M. C. Massie June 28, 1904. The inventor employs a time-phase changing device, which consists of a transformer with stationary primary and rotatable secondary, the latter being wound with two coils separated from each other by 90 mechanical degrees. The e.m.f. produced in the two secondary coils forces current through the primary coils of a two-phase motor, the rotor of which is rigidly connected to the rotatable member of the time-phase changing device, and the secondary of which remains at all times mechanically displaced from the most active of the primary phases. It does not appear wherein the new motor excels as to simplicity in construction and operation the well-known commercial self-starting and variable-speed, single-phase machines.

MARCONI PATENT ON SYNTONIC WIRELESS TELEGRAPHY.—The subject of tuning in wireless telegraphy is again brought forward prominently by the issue June 28, 1904, of a patent to Guglielmo Marconi, upon an application filed November 10, 1900. The essential elements of the system include the insertion in the aerial conductor (at both stations) of inductances variable at will so as to render the oscillating periods of the two circuits at each station in accord with each other. The capacity and self-induction of the four circuits—that is, the primary and secondary circuits at the transmitting station and the primary and secondary circuits at any one of the receiving stations in a communicating system—are each and all to be independently adjusted so as to make the product of the self-induction and the capacity the same in each case, or multiples of each other; that is to say, the electrical time periods of the four circuits are to be the same or octaves of each other. The time period of the circuits at each receiving station is so arranged as to be different from those of the other stations. If the time periods of the circuits of the transmitting station are varied until they are in resonance with those of one of the receiving stations, that one alone of all of the receiving stations will respond, provided that the distance between the transmitting and receiving stations is not too small. The specification of the patent gives complete details of apparatus for accomplishing the results desired, while the claims, 20 in number, appear to cover broadly the method of using a variable inductance for the purpose of bringing the circuits at the stations into electrical resonance with each other.

THERMOSTATIC DEVICE.—In order to detect a sudden increase in temperature and to arrange for giving an alarm in case of fire, C. F. Hilkier has devised an interesting thermostat which forms the subject of a patent issued June 28, 1904. Within the upper portions of the two branches of a U-shaped tube is contained a volatile liquid having a determined boiling point, while fused into the lower portion of the tube are two platinum wires covered under normal temperature conditions with mercury, which occupies the tube to a height slightly above the common level of the platinum wires. One branch of the tube is surrounded by a sleeve, which insulates it from radiant heat. A sudden and excessive change in temperature of the surrounding air will cause the liquid in the thermally exposed portion of the tube to boil, and the unbalanced pressure on its two surfaces will force the mercury up the thermally insulated portion, thereby electrically separating the mercury and one of the platinum wires and interrupting the current in the relay to an alarm circuit.

A NEW FLAMING ARC LAMP.—Messrs. Malcolm H. Baker and Samuel P. Wilbur have been granted patents under date of June 7 on a new type of arc lamp designed for the use of composite or "flaming" carbons. In the use of such carbons it has been customary to point the electrodes down and establish the arc across the lower ends, and to hold and "fan out" the arc by governing the magnetic field. But when burning in this manner the heat of the arc causes an updraft acting against the downward pull of the magnetic field and tending to bend the arc toward the sides of the electrodes, thereby producing fluctuations in the light. To obviate this disadvantage the inventors give the electrodes the form of two broad plates. For example, plates 6 in. wide, 2½ in. high and ¼ in. thick may be used, giving a life of 50 hours on 7 amp. The plates are mounted vertically and parallel, and the arc between the upper edges is governed by a magnetic field created by a winding in shunt with the arc. Above the arc is a large reflecting surface to reflect the light in suitable directions.

LETTER TO THE EDITORS.

The Inventor's Point of View.

To the Editors of Electrical World and Engineer:

SIRS:—Owing to the importance of patent rights upon the welfare of your readers who are inventors and manufacturers, I take it for granted that you and your correspondents are willing that the recent interesting discussion on patents be continued. In your issue of June 4, 1904, page 1099, you allege that I appear "to lose sight of the fact that a patent monopoly is not granted as a personal reward, but indirectly to encourage national prosperity by directly encouraging invention."

Reward to the inventor and benefit to the public are both invariably joined together in all opinions on the foundation of the patent system in the United States. See for example the decision of the Supreme Court, as handed down by Judge Wallace, in Seymour vs. Osborne, 11 Wallace, 533, 1870. "Letters patent are not to be regarded as monopolies created by the executive authorities at the expense and to the prejudice of all the community except the persons therein named as the patentees, but as public franchises granted * * * * as a matter of compensation to the inventors for their labor, toil and expense, in making the inventions." See also Lowell vs. Lewis, 1 Mason, 182; Story, 1817. "The law confers an exclusive patent right on the inventor * * * as an encouragement and reward for his ingenuity, and for the expense and labor attending his invention." See also Allen vs. Hunter, 6 McLean, 303; McLean, 1885. "And the law gives him the exclusive use of the thing invented or discovered, for a few years, as a compensation for his 'ingenuity, labor and expense in producing it.'"

Similar opinions of the court occur over and over again as far as the question is concerned from an inventor's point of view. You say further, "Any public monopoly is in itself an evil, to which principle

a patent monopoly is not an exception." In answer to this, see almost any decision of the court on the matter of monopolies, for example, another portion of the decision last above quoted: "Patentees are not monopolists. This objection is often made and it has its effect upon society. The imputation is unjust and impolitic. A monopolist is one who, by the exercise of the sovereign power, takes that from the public which belongs to it, and gives to the grantee and his assigns an exclusive use. On these grounds, monopolies are justly odious. It enables a favored individual to tax the community, for his exclusive benefit, for the use of that to which every other person in the community abstractedly has an equal right with himself. Under the patent law this can never be done. No exclusive right can be granted for anything which the patentee has not invented or discovered. If he claim anything which was before known, his patent is void, so that the law repudiates a monopoly."

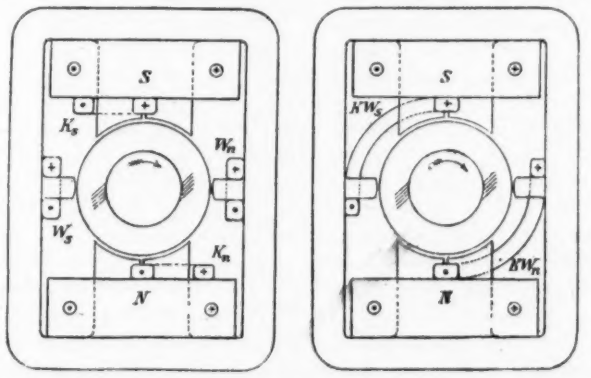
In this connection, relating as it does to the nature of a patent contract, I notice a serious mistake in the address, "The Nature of Patents and Inventions," by Mr. Samuel G. McMeen, in your issue of May 28, paragraph 4, where it says: "It is not true that a patent granted by the United States may be renewed." It would be more accurate to state, as in the Rules of Practice, No. 180, "Patents cannot be extended except by Act of Congress." Otherwise, his address was excellent.

NEW YORK. EDWARD P. THOMPSON.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

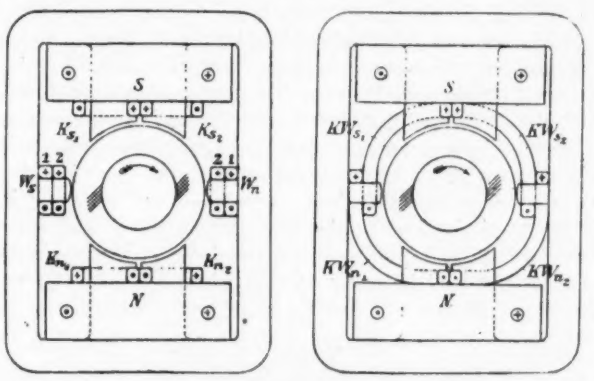
DYNAMOS, MOTORS AND TRANSFORMERS.

Compensating Windings and Commutation Poles for Direct-Current Dynamos.—SEIDENER.—To prevent sparking at the commutator, if the brush resistance alone is not sufficient for satisfactory commutation, it becomes necessary to produce strong artificial communication fields or fluxes. These fluxes must be opposite to the armature flux and must act at those places of the armature where the armature coils are short-circuited by the brushes. To produce these commutation fluxes, compensating windings (passing through the pole shoes) as well as special commutation poles have been suggested. For high-speed machines (where the problem of good commutation becomes specially difficult) the reactance voltage is high and may be as high as the e.m.f. induced in the armature coils by the main field; it follows that much copper is required for the compensating windings and commutation pole windings, to make them effective. The author discusses various arrangements which enable him to save considerable copper. These arrangements consist in the simultaneous use of compensating windings and commutation poles. The simplest method is shown in Fig. 1, where *N* and *S*



FIGS. 1 AND 2.—COMPENSATING WINDINGS AND COMMUTATING POLES.

are the poles of the field, *Ks* and *Kn* are compensating windings and *Ws* and *Wn* the special commutation poles. If *n i* is the number of armature ampere-turns, *p* the number of pairs of poles, the rule is to provide the compensating winding (*Ks, Kn*) with *n i/2p* ampere-turns as are required for producing the pure commutation field; in this case the conditions for good commutation are fulfilled in the most satisfactory way, as shown by the author. If now *Ks, Ws, Kn* and *Wn* have all the same number of ampere-turns, it will be seen that (in looking toward the armature from the outside) the right side of the coil, *Ks,* and the left side of the coil, *Ws,* neutralize each other in the space between *Ks* and *Ws;* they are inactive with respect to the formation of a flux passing through the armature. It is, therefore, possible to connect the left side of coil *Ks* with the right side of coil *Ws,* so as to form one winding, as shown in Fig. 2. In this way a considerable amount of copper is saved. The arrangement of Fig. 3 is distinguished from that in Fig. 1 in so far as in Fig. 3 each compensating coil is divided into two equal parts, Ks_1 and Ks_2, Kn_1 and Kn_2, and in the same way the commutation pole coils are divided into the coils Ws_1, Ws_2, Wn_1, Wn_2. The arrangement of Fig. 4 follows from Fig. 3 in the same way as Fig. 2 from Fig. 1, with a resulting saving in copper. On account of the symmetrical arrangement of Figs. 3 and 4 there is no compounding action in these cases, while in Figs. 1 and 2 the coils, *K W*, produce a compounding effect.—*Zeit. f. Elek.* (Vienna), June 12.



FIGS. 3 AND 4.—COMPENSATING WINDINGS AND COMMUTATING POLES.

Testing Induction Motors.—WEEKES.—A full account of a Hopkinson test for polyphase induction motors. The test requires two motors of approximately the same output. They are bolted to the bedplate in the test room and connected together by a belt. The pulleys are so selected that the machine which acts as a motor drives the second machine as a generator at slightly over-synchronous speed. Under these conditions, the second machine, acting as a generator, supplies the bulk of the power to the first one, running as motor. It then remains to measure the watts supplied from the power station at the works, and the watts circulating between the two machines under trial. Full data are given of the application of this method to the test of two 10-hp motors and to the test of a 30-hp motor, driving a 25-hp motor as a generator. The method of finding efficiency and power factor by means of this test is described. The advantages of this method of testing are summed up as follows: The method is very accurate, since it allows of the losses in the two machines being read directly off low-reading wattmeters. The use of mechanical brakes is avoided. There is an economy in power consumption; in the test in which the 30-hp motor was working at full load, only 9.4 kw were taken from the mains. With this expenditure of power two motors were tested together, which would have required approximately 45 kw to test if run against brake. Finally, since two machines are being tested simultaneously, the time required is reduced.—Lond. *Elec. Eng.,* June 17.

Transformers.—PECK.—An illustrated article on transformers for long-distance transmission. He first gives statistical data on the development of high-voltage transformers from 1892 to 1902. The number of transformers made by one American company for high-voltage transmission was 985 in 1902 (against 65 in 1892), with a total output of 248,982 kw (against 406), the maximum voltage being 50,000 (against 10,000), the maximum capacity 2,200 kw (against 10 kw). He discusses the construction of high-voltage transformers and distinguishes the following three classes: Oil-insulated, self-cooling; oil-insulated, water-cooled; air-blast. While for certain

classes of service any type may be chosen there is a field for which each is particularly well suited. The self-cooling transformer for moderate-sized units of high and low-voltage is particularly fitted for use in small sub-stations where no regular attendance can be given. The water-cooled transformer for units of large capacity and for any voltage is especially suited for very large stations where cooling water may easily be obtained. The air-blast transformer, for units of any size and for voltages not exceeding approximately 30,000, may be used for large stations where there is constant supervision and where the presence of oil required for oil-insulated transformers might be considered objectionable. The author discusses at some length the use and connection of transformers in two-phase and three-phase transmissions.—*Cassier's Mag.*, June.

Ageing of Sheet Iron for Dynamos.—STERN, EPSTEIN, SOSCHINSKI.—An account of results on the ageing of sheet iron for dynamos. The tests were made by three German electric manufacturing companies. The results are given in tables and diagrams. Only Soschinski sums up his observations; they are as follows: Even at ordinary temperature of the room, the losses increase in the first months, but it seems that this increase of the losses at the ordinary temperature of the room is restricted to about the first 10 weeks and is then completed. Sheets of 0.35 mm. thickness show a greater tendency to ageing than sheets of 0.5 mm. The ageing is, however, small, varying for most sheets between 3 and 8 per cent. of the original loss figure; for one sheet only, which when received had been recognized as being non-homogeneous, the increase of loss was 25 per cent. Sheets made from alloys with aluminum and silicon, respectively, show a strong tendency to age and the loss was greater with an alloy containing 2 per cent. of aluminum than with one containing 1 per cent.; in these two cases it was 33 and 15 per cent., respectively. The increase of the losses is always due to an increase of the hysteresis loss, while the eddy-current loss remains generally constant and shows a tendency even to decrease in the alloy sheets. The figures obtained by static measurements agree fairly well with those obtained by the wattmeter.—*Elek. Zeit.*, June 16.

REFERENCE.

Voltage Regulator.—DUPUY.—An illustrated description of a voltage regulator for alternators built by the Thomson-Houston Company. The principle of the apparatus is to render the voltage at the bus-bars constant by opening or closing a contact which short-circuits a rheostat in the exciting circuit.—*L'Eclairage Elec.*, June 11.

LIGHTS AND LIGHTING.

Magnetite Lamp.—In an editorial on Steinmetz's magnetic arc lamp, its high efficiency and long life are pointed out and the invention is said to look promising, although more exact figures are wanted concerning efficiency. The fact that the copper block which forms one electrode does not show signs of burning after some time, is thought to be explained by the assumption that the current does not impinge upon the copper terminal at a single point, but that the contact surface is much larger, since metal vapors are comparatively good conductors of electricity.—Lond. *Elec.*, June 17.

REFERENCES.

Emergency Car Lighting.—An article on the "positive auxiliary car lighting system," which has been adopted on one or two interurban electric railways. Whenever through any cause the regular operating and lighting current is interrupted, a series of auxiliary lamps are lighted automatically by current from a storage battery.—*St. R'y Jour.*, June 18.

Lighting of a Prison.—An illustrated description of the electric lighting system of the Wormwood-Scrubbs Prison. Each cell is provided with an 8-cp lamp. "Simplex" screwed steel conduit with brazed seam is used throughout.—Lond. *Elec.*, June 17.

POWER.

Electric Power Transmission.—STILLWELL.—A very long and fully illustrated article on the development of electric power transmission. He first gives several statistical tables. The number of American electric central stations in 1902 was 3,620, with a total output per year of 2,453,502,652 kw-hours. The direct-current, constant-voltage dynamos make up 27.2 per cent., the direct-current, constant-ampere dynamos 12.0 per cent., and the alternating and polyphase-current dynamos 60.8 per cent. of the total horse-power capacity. He then discusses the construction of cables and conduits, transmission lines and insulators. Probably the most valuable single addition to apparatus developed since 1893 for high-potential transmission is, he considers, the electrically operated oil switch. He then deals with various apparatus, like synchronism indicators, automatic circuit-breakers, lightning arresters, and deals at some length with the erection of the pole line. Power supplied in bulk is then discussed. The opportunity for profit is said to rest chiefly upon three facts: first, that power can be produced more economically by a very large steam plant than by a small one; second, that the aggregate power which a central station plant, supplying a certain district, is called upon to develop at any given time, is very much less than the sum of the maximum outputs of the small plants required to do the same work; third, that an electric motor occupies much less space and requires less attention than a steam plant. A 50,000-hp steam plant, supplying electric power for general purposes to a district having a radius of 50 miles, will burn about 3 pounds of coal per average kw-hour delivered throughout the district, while the average consumption of coal by the steam plants which such a central power plant would displace is usually not less than 10 pounds per kw-hour. As regards the ratio of the maximum output of the central station to the sum of the maximum outputs of the displaced small plants, he thinks that this ratio will rarely be higher than 2 to 3 and in some instances it is as low as 1 to 3. In other words, a 50,000-hp central station will rarely fail to do the work of small plants aggregating 75,000 hp and in some instances will be capable of doing the work of small plants aggregating 150,000 hp. Transmission of power from coal fields to large cities works out much less favorably, since it has to compete with the alternative plan of transporting the coal to the city or to a point near it. In general the difference in the cost of coal delivered to a plant in the city and the cost of coal delivered to a smaller plant located in the coal fields at a distance of 250 miles from the city will not represent as much as 10 per cent. upon the difference in the annual cost of the two plants thus respectively located. If the possibility of interruption of service in the case of the distant plant is taken into account, the better plan seems to be to locate the central station near the city. The author thinks the greatest of all fields for alternating-current transmission may be in the application of electricity to the operation to railways.—*Cassier's Mag.*, June.

Power in Transvaal.—An article on machinery improvements in Transvaal mines. The restricted labor supply has stimulated invention, the progress being most marked in the more extended use of rock drills and in improved methods of handling the ore and waste products both in the mine and on the surface. Formerly for power distribution purposes, belting and friction clutches were used, but in the newer installations the practice is to install the mill engine for the purpose of driving the stamp batteries, which are in constant demand, and to generate electric power by separate engines for working the other machines, motors being used for driving rock-breakers, storing tables, tailing wells, pumps, conveyors and mechanical hauling plant generally. In some cases within the last few months steam turbines have been introduced for running electric generators. It is assumed that the three-phase, alternating-current system will be the most convenient, the power being generated by directly-connected sets of from 250 to 1,000 kw, each working at 1,000 to 5,000 volts pressure, and at about 50 cycles. There is at present in construction from a central station a distribution system at 10,000 volts to one of the gold centers. As to mine pumps, in cases of shafts not exceeding 1,500 ft. in depth, the Cornish is the most favored on the Rand, 44.1 per cent. of the total number being so equipped. It is not likely, however, that the system will be extended to deep-level shafts, owing to the high initial cost and the weight of rods. Electric pumps come second, being used in 20.6 per cent. of the total number equipped. These pumps are invariably of the three-throw, single-acting type, operated by gearing. In one case the pump works from the bottom of the shaft to the surface against a head of 1,220 ft.—Lond. *Eng'ing*, June 17.

Electric Installation of Brewery.—A description of the electric installation of a brewery in Rannersdorf, near Vienna. The power house contains two steam-driven, 100-kw-ampere, 220-volt, 25-period, three-phase generators, and two 35-kw. 220-volt, direct-current generators. Direct current is used for lighting and for the elevator motors. For lighting the voltage of 220 is divided into halves by means of a storage battery consisting of 132 cells with a capacity of 518 amp.-hours, if discharged in 10 hours. For most power pur-

poses, three-phase induction motors are used.—*Zeit. f. Elek.* (Vienna), June 12.

REFERENCES.

High-Tension Transmission for Railways.—DAVIS.—An illustrated article on high-tension power transmission for railways. A satisfactory way of determining the most economical size of wire under given conditions of load and voltage, and the different methods of connecting the transmission line with the sub-stations are shown in diagrams. The writer discusses the construction of the overhead line and recommends steel poles or towers as a rule, because, while more expensive, longer spans can be used and in this way the cost kept down. He also discusses different types of insulators.—*St. R'y Jour.*, June 25.

Electric System of Oil Separation for Boiler Water.—A description of the Davies-Perrett process which was recently noticed in the Digest. Detailed drawings are given of the apparatus used.—Lond. *Eng'ing*, June 17.

TRACTION.

Brakes.—KRAMER.—The first part of what, it appears, will be a very long critical serial on brakes for electric street railways. He first gives a summary of the various conditions which must be fulfilled and divides the different types of brakes in various classes and subdivisions. He then gives the results of some tests made by him concerning the coefficients of sliding friction between wheel and rail and between wheel and brake-shoe. These tests were made on a level road and the cars were run partly in one direction and partly in the other, to eliminate the influence of wind, etc. A trailer was coupled to a motor car by means of a dynamometer, so that the tractive force, R, of the motor car upon the trailer could be measured directly in kilograms; first, the brakes were applied on the wheels of the trailer with full force; secondly, they were applied with only such force that the wheels were rolling on the rails, without sliding. Tests were made with speeds of 6, 10 and 14 km. per hour. In those cases in which sand was used on the rails, it was applied to them from the back of the motor car, so that the front wheels of the trailer passed over the full layer of sand, while the layer of sand over which the back wheels had to pass was then naturally smaller. If R is the tractive force and G the weight of the car, the coefficient, m, of sliding friction between wheel and rail is defined by $m = R \div G$. The coefficient, M, of the sliding friction between wheel and brake-shoe is defined by $M = R' \div Q$, if R' is the tractive force and Q the pressure of the brake-shoes on the wheels. He found the following figures on the influence of sand and of the condition of the road; they are approximately correct for speeds between 6 and 14 km. per hour: m is the coefficient of friction between wheel and rail, M between wheel and brake-shoe, the condition of the rails being assumed to be dry and without sand in both cases:

Condition of rails.	*Without sand.*	*With sand.*
Dry.....	m	$3\ m$
	M	$2\ M$
Slippery.....	$0.5\ m$	$1.6\ m$
	$0.56\ M$	$1.2\ M$

He then begins to discuss separately the types of brakes in which the kinetic energy of the car is changed into electrical energy. He first discusses the short-circuit brake at great length and in detail and concludes that it is not satisfactory, mainly for the reason that it does not fulfill the main condition of being and remaining always operative under all and any circumstances; moreover, other necessary conditions are also only partly fulfilled. He then begins to discuss the eddy-current brake.—*Elek. Bahnen*, No. 12, June.

REFERENCES.

Tramways in France.—A note stating that the French tramways aggregate 3,500 miles and are worked by 172 companies, who spend $161,000,000 on their construction. The average net income per mile amounts to $650.25. In the department of the Seine the length of the tramways is 231 miles. Their initial cost was $47,250,000, and they are worked by 10 companies. During the first half year of 1903 the total receipts were $4,625,000, the net profit being $860,000. Three of these companies, however, are working at a loss; the losses in the second half of the year 1903 being $33,400, $22,200 and $4,000, respectively.—Lond. *Elec.*, June 10.

Third-Rail Facilities.—An editorial note on two more third-rail fatalities which occurred recently and which bring up the total number of such accidents on the Northeastern and the Lancashire & Yorkshire Railways to four. The adoption of guard planks is recommended.—Lond. *Elec.*, June 17.

Control of Motors of Different Cars from a Single Switch.—See the abstract on an "Automatic Controller for Electric Circuits," under "Installations, Systems and Applications."

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Automatic Controller for Electric Circuits.—A note on a recent English patent of Zweigoergk, for an automatic controller for electric circuits. The device may be used for various purposes, and particularly on electric trains where there are a number of motors on different cars all operated from one starting switch at the head of the train. The device consists essentially of a small bipolar continuous-current motor, the action of which results in the gradual cutting in or cutting out of the starting resistances of the main motor or a group of motors, as the case may be. One of the field coils of the auxiliary motor is in series with the armature of this small motor and this circuit is connected in shunt across the power supply. The other field coil is connected in series with the main motor. The coil first mentioned, called the "shunt" coil, is opposed in action to the second or "series" coil. While, therefore, the one coil tends to rotate the armature in one direction, the other field coil has the opposite effect. One end of the shaft of the small motor is cranked, and a spring, connecting this crank with a fixed point on the motor, tends to bring the armature always into the same position. This arrangement minimizes the risk of the starting lever coming to rest between two contacts. The rotation of the armature is transmitted to the lever of the starter by a one-toothed pinion and a toothed segment. When the main motor is to be started, current is switched on to the shunt circuit of the small motor, and the armature of the latter begins to rotate and cuts out resistance in the circuit of the main motor. This cutting out of resistance continues until the current of the main motor has reached a certain value, when the action of the series field coil balances that of the shunt coil and the armature remains stationary until the main current has died down, owing to the building up of the large motor. In order to stop the motor, the shunt coil of the auxiliary machine is short-circuited. The series coil now effects a rapid backward rotation of the small armature and of the starting lever.—Lond. *Elec.*, June 10.

New Orleans.—A description of the power plants of the New Orleans Railways Company, which conducts a general power and lighting business in addition to its railway lines. There are at present seven stations, the total output being about 29,000 hp. Nearly all the boilers use or are arranged to use oil for fuel. The principal lighting station supplies current for the three-wire, direct-current distribution system, and it also contains three 500-kw, 2,300-volt, 60-cycle alternators. One of the latter is to be replaced by a direct-current, 275-volt unit of the same capacity. The main railway station contains one 1,500-kw and two 2,250-kw, 575-volt, direct-current generators.—*St. R'y Jour.*, June 18.

British Lighting Station.—An illustrated description of the electric lighting station of Faversham, a small town of 12,000 inhabitants. Gas engines are used for driving the generators. There are two 85-hp gas engines running at 290 revolutions. The ignition is electric; at starting the electric current for this purpose is derived from a 10-volt primary battery, and when the engine has been brought up to full speed the current is furnished by two small electric generators belt-driven from the engine. Direct-connected to the engines are two six-pole, 58-kw, 460-volt, compound-wound dynamos. There is also a storage battery of 250 cells with a capacity of 500 amp.-hours, and a balancer booster set.—Lond. *Elec.*, June 17.

ELECTRO-PHYSICS AND MAGNETISM.

Effect of Pressure on Magnetic Induction.—FRISBIE.—A description of an experimental investigation from which the authoress draws the following conclusions. The application of hydrostatic pressure to soft iron anchor rings changes the coefficient of magnetic permeability of the iron, besides altering the amount of residual magnetism when the pressure is applied or removed; the amount of the change varies for different pieces of iron. With unannealed iron

the sign of the change depends upon the strength of the magnetizing field, the effect in small fields being a decrease and in stronger fields an increase; the change of sign occurs for $H = 4.5$ or 5 c.g.s. units. The magnitude of the alteration is a function of both field and pressure. With annealed iron an increase is found for pressure with all values of the field between 0.54 and 9.67 absolute units.—*Phys. Rev.*, June.

Coherence and Recoherence.—SHAW AND GARRETT.—An abstract of a (British) Physical Society paper, giving the results of an investigation in which the authors found that coherence can be explained and only explained by Lodge's original theory of fusion. They also established an after-effect which may be due to orientation of the particles at the contact, although it is still unexplained. When electric radiation falls on a contact of two wires, under suitable conditions coherence occurs. On applying a small measured force the cohered surfaces separate. On bringing them in contact again at the same places, coherence will follow, but not always without the incidence of electric radiation. This can be repeated two or three times, but the power to cohere spontaneously soon vanishes. This spontaneous coherence is called re-coherence.—Lond. *Elec.*, June 10.

REFERENCES.

Viscosity.—REYNOLDS.—The first part of a paper on the viscosity coefficient of air, with an inquiry into the effect of the Röntgen rays thereon. In the present installment he gives a review of the subject and a very full biography.—*Phys. Rev.*, June.

Action Between Magnets.—CHREE.—An abstract of a (British) Physical Society paper on the law of action between magnets and its bearing on the determination of the horizontal component of the earth's magnetic field with unifilar magnetometers.—Lond. *Elec.*, June 10.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrometallurgy of Iron and Steel.—An article in which it is pointed out that up to the present the use of the electric furnace has been mainly successful on a commercial scale for the manufacture of ferro-alloys and for the production of special steels. Various attempts have, however, been made in Europe to apply electric furnace processes also to the reduction of iron ores for making pig iron and steel. An abstract is given of the report of the commission appointed by the Canadian Government to investigate the different electric furnace processes in Europe. The main part of the report deals with the Keller process; three sets of experiments were made, as follows: First, electric reduction of iron ore for the production of different classes of pig, gray, white and mottled; second, electric reduction of iron ores containing a definite amount of carbon in the charge, with a view of ascertaining the amount of electrical energy absorbed in the production of one ton of pig iron; third, the manufacture of ordinary steel of good quality from the pig manufactured in the preceding experiments. The results were quite satisfactory, the workmen being ordinary Italian laborers without any special training. The electric energy absorbed per ton of pig was found to be 0.226 hp-year. The total cost, exclusive of royalty, being given as $10.60, in this estimate the cost of electric hp-year is taken as $10. It was pointed out that these results were obtained in furnaces not specially adapted to this work, since they were ordinarily used for making ferro alloys. Some information is also given on the methods of making special steels in use at Gysinge, Sweden, and at Lapras, France.—*Electrochem. Ind.*, July.

Electrolytic Preparation of Bromoform.—MÜLLER AND LOEBE.—A description of a method for preparing bromoform by electrolysis of a solution of potassium bromide in presence of acetone. During electrolysis a stream of carbonic acid is passed through the electrolyte. To get a high ampere-hour efficiency without the use of a diaphragm, it is necessary to prevent any reductions going on at the cathode; this is done by the addition of a small amount of potassium chromate to the electrolyte.—*Zeit. f. Elektrochemie*, June 17.

Electrolytic Preparation of Chloroform.—TEEPLE.—A description of a method of producing chloroform by electrolysis of a chloride solution in the presence of acetone with a high current density at the cathode and a comparatively low one at the anode. During electrolysis a slow stream of chlorine is passed through the solution in order to neutralize any alkali being formed.—*Jour. Am. Chem. Soc.*, May.

REFERENCES.

Diaphragm Process for the Production of Bleaching Powder and Caustic Alkali.—TARTY AND GUYE.—A long account of an extended investigation of diaphragm cells for the electrolysis of sodium chloride. They experimented with a great number of diaphragms and describe two measurements by which the characteristic constants of any diaphragm may be determined.—*Jour. de Chim. Phys.*, March, April, May.

Jungner Battery.—SCHOOP.—A communication and an article on the historical development of the Jungner battery. Jungner is stated to have begun his work in 1892 and it is said that he knew very well that the weak points of his nickel-cadmium and nickel-iron cells were due to the insufficient means and apparatus for making the same. This is the reason why he has not placed them on the market. Nevertheless, it is claimed that Jungner was the first to devise the alkaline accumulator with constant electrolyte.—*Elek. Zeit.*, May 26; *Centralblatt f. Accum.*, June 15.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Silver Voltameter.—GUTHE.—A Physical Society paper pointing out the reasons why the ordinary type of silver voltameter is not satisfactory. T. W. Richards has found that a complex ion is formed at the anode, which, when transported to the cathode, will deposit too much silver. For this reason he surrounds the silver rod, which is the anode, by a porous cup and keeps the level of the electrolyte in the cup lower than that of the outside. Guthe has devised a modification of this voltameter, which is more convenient in manipulation, and has also devised another form which is called the large silver anode voltameter. Granulated silver is placed in a layer about 0.5 cm. deep at the bottom of a large porous cup; upon this is pressed the silver plate forming the anode connection; the whole is immersed in a bowl of platinum, which is the cathode, and contains a neutral 20 per cent. solution of silver nitrate. The author found that Richards' type and his own two types give very accurate and consistent results.—*Phys. Rev.*, June.

TELEGRAPHY, TELEPHONY AND SIGNALS.

REFERENCES.

Telephone Exchange.—An illustrated description of the new Holborn telephone exchange in London, which is designed for an ultimate capacity of 8,700 direct subscribers' lines. The central battery system has been adopted in its entirety. There are two classes of supervisors. The actual supervising operators walk up and down all the time and can thus keep the operators well under control, while a number of monitors are set aside to answer inquiries, receive complaints from subscribers, and to listen in at the operator circuits. In addition there is a chief room operator and a switch room manager.—Lond. *Elec.*, June 10.

Wireless Telegraphy.—FERRIE.—A summary of the general theories of the phenomena of wireless telegraphy. He endeavors to show that these phenomena are only consequences of the property of Hertzian waves, and the majority of the same may be illustrated by analogies in the transmission and repulsion of material vibrations.—*L'Eclairage Elec.*, June 4.

MISCELLANEOUS.

Electric Oven for Bakeries.—A note stating that a bakery for which heat is generated electrically has recently been put in operation in Montauban. The conversion has been carried out without any essential alterations in the construction of the oven, and heating by wood may be reverted to whenever required. The oven is circular in shape and is completely closed, save at the front opening. Twenty resistances, each absorbing 700 watts, are placed upon a platform of girder work, which, by means of pulleys, may be lowered and raised. These resistances are divided into four groups. Two groups, consuming 37.5 amp. each, are placed in the center of the oven, while the remaining two groups, consuming 25 amp. each, are placed nearer to the side of the oven. Current is taken at 110 volts from the supply mains, all resistances being connected in parallel. At starting the resistance frame is lowered. After one hour and 26 minutes, that is, after 20.625 kw-hours have been expended, the temperature of the oven has attained its proper value. The resistance platform is then raised and the unbaked loaves are inserted. The consumption of energy is simultaneously reduced to 5.5 kw.—Lond. *Elec.*, June 10.

Intercommunication on the World's Fair Grounds.

BY CLOYD MARSHALL.

THE value of rapid and easy communication is so fully appreciated that the telegraph and telephone lines precede the army, the railroad and even the builder. The best example ever shown of a temporary installation is that of the telegraph, telephone and fire alarm systems throughout the World's Fair Grounds in St. Louis. The latest and most modern equipment is used throughout, and the whole installation would be a credit to any city. This result has been through the combined efforts of the electrical manufacturers, the operating telephone and telegraph companies, and the World's Fair officials. The central stations and most of the apparatus are located in the Electricity Building, where the exhibit and commercial features can be combined to best advantage. Telephones are freely distributed for the use of both exhibitors and the public, and, by means of the connection through the St. Louis exchanges, one can converse from one exhibit to another, to any building on the Fair Grounds, to any place in the city or as far east

FIG. 1.—EXHIBIT OF SWITCHBOARDS BY THE KELLOGG SWITCHBOARD & SUPPLY COMPANY.

as the Atlantic and west to the Rocky Mountains. Telegrams, cablegrams and even aerograms can be sent from the telegraph stations within the building to any part of the world. Although these facilities are in universal use, yet but very few understand the operations necessary to give such service, so that the different operating companies have demonstrators to explain the workings of the apparatus and systems.

The 1,240 acres contained in the Exposition are thoroughly covered with underground cables, connecting over 500 Kinloch telephones placed in every desirable location, affording instant communication with the separate departments of the Exposition Company, the greater portion of the exhibitors and most of the State Buildings. The service is handled by the Kinloch Company, employing sixteen operators for the purpose. Positions for wire chief and chief operator are a part of the working exchange.

Besides the exchange, there is an 1,800-line section of Kellogg switchboard, which is an exact duplicate of the sections of the Buffalo, Cleveland and Los Angeles switchboards, three of the largest installations, all of which are in successful operation. Each piece of apparatus used in the construction of telephones and switchboards is shown in the minutest detail. All the several styles of telephones have been erected and their uses made plain. Machines for insulating copper wire are in full operation, with skilled mechanics in attendance.

The rate of improvement in telephone apparatus to the layman's mind is judged by his daily contact with the receiver and transmitter. He has no conception of the many engineering difficulties overcome until he has the opportunity to inspect a central exchange

FIG. 3.—KELLOGG SWITCHBOARD & SUPPLY COMPANY'S BOOTH.

and the apparatus therein. No better opportunity could be afforded for this than a visit to the operating telephone exchanges in the Electricity Building. The Kellogg Switchboard & Supply Company has installed in its exhibit a full lamp, full multiple, common battery board of 1,200 lines, equipped with an ultimate capacity of 3,600 lines. The service rendered extends throughout the entire Exposition Grounds and buildings, and connects, through the Kinloch Telephone Company, with the city of St. Louis and long-distance lines. This

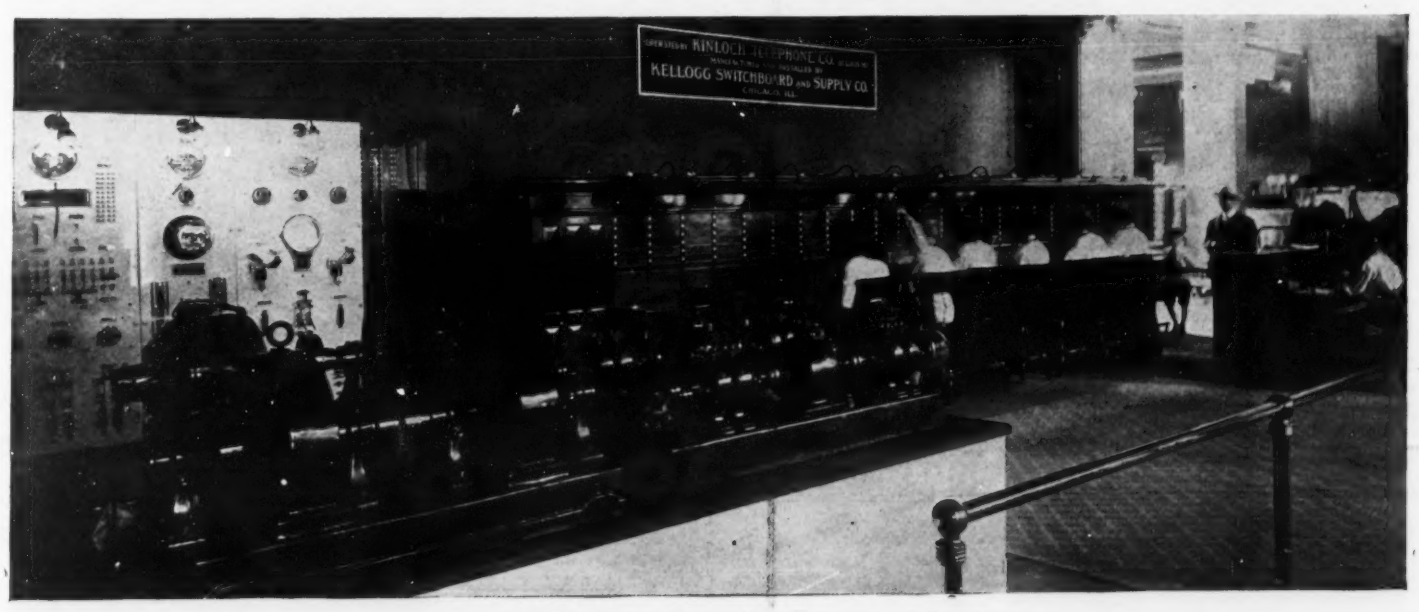


FIG. 2.—KINLOCH TELEPHONE EXCHANGE, ELECTRICITY BUILDING.

board is operated by a power plant and its complement of batteries and generators on the floor of the exhibit. The cables, terminals, relays and distributing frames are also subject to inspection.

The booth in which the exchange and telephone apparatus is exhibited occupies 3,700 sq. ft. of space, with a balcony for office

purposes which covers 800 sq. ft. Both the booth and office are handsomely finished in mahogany and blue, with solid mahogany furniture, live palms, etc. The booth is lighted by thirty-nine Nernst single-glower lamps and sixty-four incandescent lamps, and the office is lighted by ten Nernst single-glower lamps. A retiring room furnished in mahogany is provided with individual lockers for the

FIG. 4.—AMERICAN TELEPHONE & TELEGRAPH COMPANY, ELECTRICITY BUILDING.

use of the operators. A visit and careful inspection of the Kellogg exhibit is well worth while for everyone who uses a telephone.

The American Telephone & Telegraph Company occupies 3,000 sq. ft. adjoining the Western Electric Company in the Electricity Building. Here is located the complete equipment of a standard Bell exchange in active operation. Service is rendered to all subscribers on the Exposition Grounds, and connection is made to all exchanges in the United States reached by long-distance lines. The switchboard has an ultimate capacity of 9,600 lines, 9,600 multiple jacks and 600 trunks, but the Exposition service requires but 1,500 lines, which are brought into the exchange through an extensive underground plant. There are nine operating positions, the one in the west end handling all incoming calls from other offices of the St. Louis exchange and from long-distance points, while the others answer the calls of subscribers connected with this board, each operator being capable of handling a maximum of sixty lines. When a subscriber makes a call a small electric lamp near the lower part of the board lights. Associated with each lamp is an answering jack by means of which the operator plugs in on the subscriber's line and takes the call. Just above the small electric lamps are the jacks for trunk lines to outlying exchanges. Through these trunk lines the operators complete connection with parties called for by subscribers connected with the exchange. In the upper portion of the board are the multiple jacks by means of which parties calling for subscribers connected with this exchange are placed in communication with them.

At the left of the board and on the same platform is a complete power plant, including a motor-generator charging set, storage battery, ringing generator and power board; also a line relay rack and an intermediate distributing board. In addition to the contract stations about the grounds, there are a large number of slot pay stations at convenient locations in the buildings where any visitor can secure local and long-distance connections at the regular rates. Besides a corps of operators at the exchange, there are several demonstrators who explain to visitors the operations and telephone connections. The exchange and exhibit is under the direction of Mr. Henry W. Pope.

The Automatic Electric Company combines with its exhibit a service throughout the Electricity Building. At convenient locations in the building and throughout the offices of the department are located automatic telephones. By this means the chief and superintendents can keep in close communication with the stenographers, assistants, clerks, janitors and guards.

The exhibit includes two complete working automatic exchanges of the 10,000 type, each with 100 stations installed. These two exchanges, now giving service throughout the Electricity Building, are connected together by a system of trunks, similar to that generally used in manual telephone practice to connect branch exchanges to each other and to the main exchange. The selection of trunks, however, is done automatically, and not through human agency, as is the case in manually-operated switchboards where a call originating in one exchange must pass through the hands of two operators to

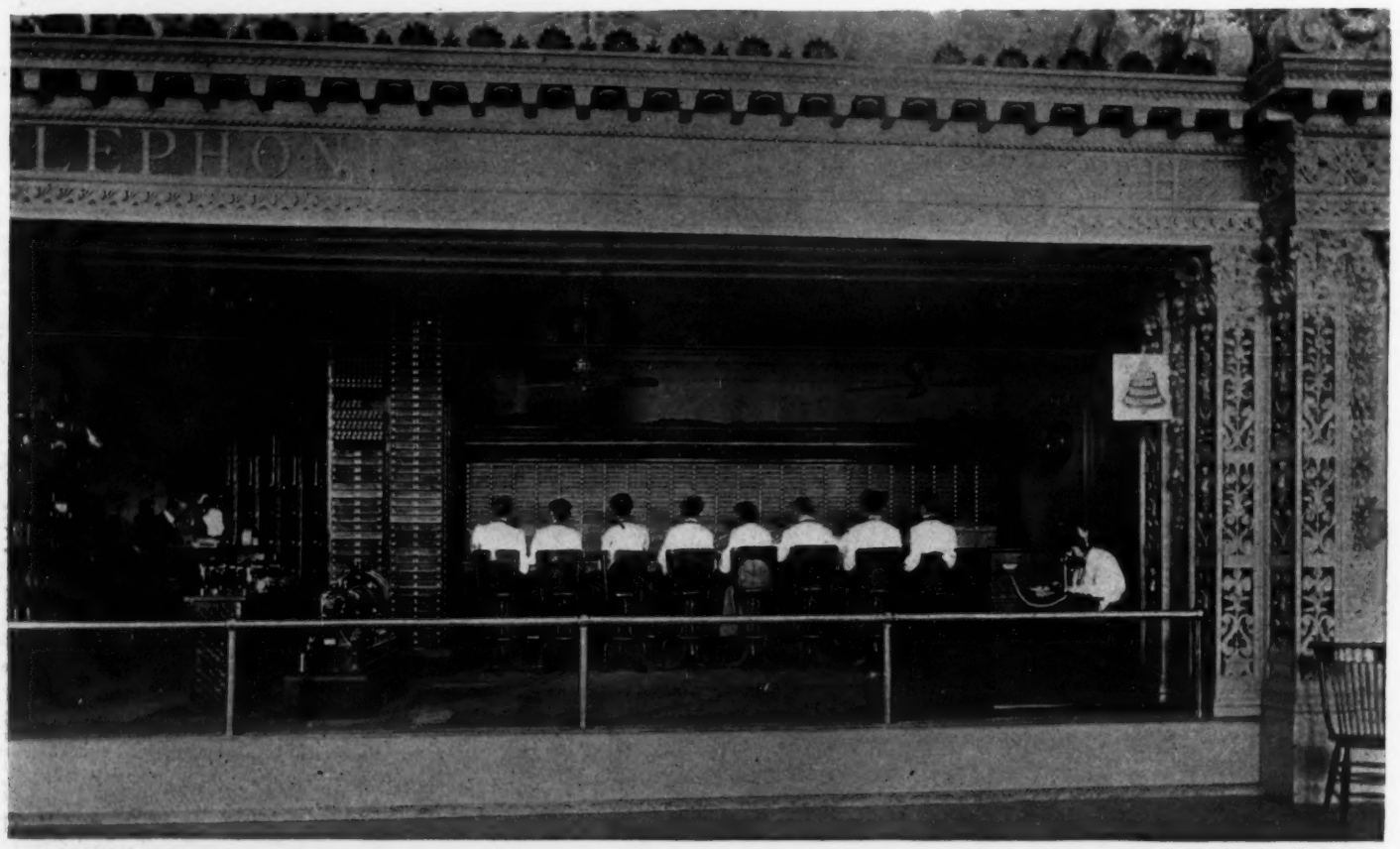


FIG. 5.—BELL TELEPHONE EXCHANGE, ELECTRICITY BUILDING.

secure connection with a telephone in another; a method which, since the number asked for must be repeated by the original to the secondary operator, of necessity consumes time. This method has the added disadvantages that it offers double opportunity for errors to occur, and requires that the subscriber's memory be burdened by the use of names prefixed to the numbers to designate various exchanges. The automatic system requires the use of no name prefixes, and the subscriber need not be aware that he is calling through more than one exchange, since the directory contains only numerical designations. In all cases three or four rotations of the calling dial will secure instantaneous and direct communication with the telephone desired.

FIG. 6.—EXHIBIT OF AUTOMATIC ELECTRIC COMPANY.

The telephones exhibited are of three types—the wall, the desk and the pedestal. This last may be used as a substitute for a desk telephone. It is movable like the latter, but instead of resting on the subscriber's desk it stands beside it at his elbow. All of these telephones are fitted with the regulation calling dial, a circular metal piece, on whose periphery are ten finger holes numbered from 1 to 10. This dial is fixed on an axis at its center, and as the finger is placed consecutively in the holes corresponding to the digits of the numbers desired, and the dial turned once for each digit, electrical impulses are conveyed to the switches at the central office setting them in operation and bringing through them the proper connections.

A toll board of ten stations is also in service, demonstrating the manner in which toll connections are given to users of automatic telephones. The rest of the apparatus displayed is of the same general character as that which may be seen in connection with any up-to-date telephone exchange, save the "tell-tale" board. This is simply a device for the instantaneous location of trouble, wherever it may arise, and consists of a number of lamps mounted on a slate slab together with a magneto bell. In case of trouble this magneto bell rings calling the attention of the attendant, and a lamp glows, by the position of which on the board the location of the trouble can be instantaneously ascertained, and promptly rectified.

FIG. 7.—BOOTH OF AUTOMATIC ELECTRIC COMPANY.

This exhibition exchange is a model of the exchanges which have been installed by the Automatic Electric Company in Chicago, Grand Rapids, Dayton, Los Angeles, and other cities. As may be noted by the illustration, the booth, covering about 2,000 sq. ft. of floor space, is very artistic and attractive in design and elegantly furnished. Visitors are courteously received and the system thoroughly explained to them by those in charge.

FIG. 8.—WESTERN UNION TELEGRAPH AND CABLE OFFICE, ELECTRICITY BUILDING.

The Western Union Telegraph & Cable Company's main World's Fair office in the Electricity Building represents a model, up-to-date working telegraph office. There are three light oak sextette tables, equipped with quadruplex, duplex, repeaters, automatic Wheatstone, etc. There is also a gold and stock ticker service carrying a full line of New York stock quotations, and New York, Chicago and St. Louis grain reports. Twenty-two wires leading from this office to the main down town office give direct connection with the larger cities. Branch offices on the grounds are located at the Inside Inn, New York State, Missouri State, Government Building, Mines and Metallurgy, Manufactures, Agricultural, Administration and Press Buildings, the Stadium, Philippine Village, and in the Siberian Railroad Station on the "Pike." These offices are connected with Electricity Building by loops, and placed on the different through circuits. Add to these the three offices of the Associated Press, and the four commission houses in the grounds, it is apparent that visitors to the Fair command telegraphic facilities unexcelled.

A large globe above the main office of the Postal Telegraph-Cable Company shows how, with its Pacific and Atlantic cable connections, the company circles the earth. The equipment of this office is modern in every particular and shows the standard types of apparatus adopted by the Postal Company. At the rear of the space there are six Holtzer-Cabot motor-generators, each giving 25 amp. and 40 volts for supplying power. There is also a complete switchboard with all the instruments and switches for regulation. Three quadruplex sets are in operation. On the tables are basket resonators and typewriting machines. The branch offices work through the common and polar sides of these sets with the St. Louis offices, thus making two wires of every single one between the Fair and the city.

FIG. 9.—POSTAL TELEGRAPH AND CABLE OFFICE, ELECTRICITY BUILDING.

Branch offices throughout the grounds are located at the Administration Building, Press Building, Inside Inn, New York State Building, Manufactures, Mines and Metallurgy, The Pike, Illinois State Building, the Agricultural Palace, the Philippine Reservation and the Government Building. In this way visitors are accommodated anywhere on the grounds.

Besides this a money order department has been established and visitors who became unexpectedly "broke" have found this service very convenient.

Special Form of Duplex Voltmeter.

The illustration given is that of a special form of duplex voltmeter designed by Mr. J. Stanley Richmond, of New York City, for use in electrolytic investigation. It consists of two voltmeters with the scales so arranged that the two needles under similar conditions move together either upward or downward. Both instruments, as will be noted, have double center zero scales, doing away with the necessity of pole-changers. The binding posts which in an ordinary voltmeter are plus and marked + are in this case minus and marked zero.

In taking readings, the body connected to the two zero posts is taken as zero; and the deflections obtained by connecting two other bodies, one to the other post of one instrument and the other to the

DUPLEX VOLTMETER.

other post of the other instrument, will give, respectively, the voltages above or below (+ or —) of such bodies in respect to the voltage of the body used as zero.

Instruments of this pattern are now being satisfactorily used by the Manhattan Subway; Richmond, Va., and other interests and give very satisfactory results. In fact, in the hands of those whose electrical knowledge is very limited they can be absolutely depended upon for the accuracy of the tabulated readings obtained. The instruments have been made for Mr. Richmond by the Weston Electrical Instrument Company, of Waverly, N. J.

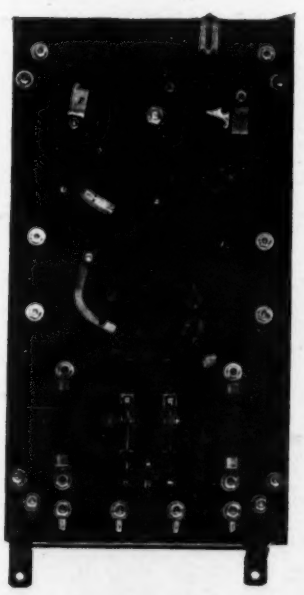
Significant Tests of Electrical Steel.

Certain recent results attained in economy and efficiency of magnetization strongly comment themselves to the attention of all interested in electrical construction or equipment. These results of tests made by Prof. Benj. F. Bailey, the well-known electrical engineer of the University of Michigan, Ann Arbor, upon two steel rings—one roughened, one annealed—submitted by the Detroit Steel casting Company, of Detroit, Mich., give interesting information concerning the magnetic qualities of steel now available for electrical purposes. The rough steel ring showed a permeability which ranged from 1,720 at 5,300 lines per sq. in. to 728 at 100,000 lines per sq. in., requiring a magnetizing force of only 40 ampere-turns per inch to produce this number of lines. Comparing the results with those obtained from a good sample of ordinary cast steel, according to data given in Wiener's book on "Practical Calculation of Dynamo-Electric Machines," it is found that at a magnetism of 85,000 lines per sq. in. the new steel requires 22 ampere-turns per inch, while the ordinary steel requires 43 ampere-turns, or about twice the magnetizing force. At a density of 100,000 lines, the ratio of magnetizing force is 39 to 100 ampere-turns per inch, showing that the new steel requires approximately one-third the magnetomotive force to produce this magnetism. The new steel may be used in smaller quantity than ordinary material, being operated at a higher density. Thus, the usual working limit might be taken at 100,000 lines instead of 85,000, saving thereby 15 per cent. in the size and weight of the magnet and requiring even then only 39 ampere-turns instead of 43. A further saving in copper and energy would be made, since the length needed to go around the magnet would be less.

The results of the test on the machined ring after annealing show that it is considerably better than the rough ring. Thus, at the usual working density of 85,000 lines, it requires only 15 ampere-turns per inch length, compared with 22 for the rough ring, 38 for good wrought iron and 43 for ordinary cast steel. At the maximum density usually employed, 100,000 lines, the annealed ring requires 31 ampere-turns, the rough ring 39, the wrought-iron ring 91, and the cast-steel ring 100.

Charts and tables further demonstrating the magnetic qualities of this new steel may be obtained by any one desiring them from the Detroit Steel Casting Company, Detroit, Mich.

Battery-Charging Rheostat Panel.



RHEOSTAT PANEL.

The Ward Leonard Electric Company, Bronxville, N. Y., has designed and perfected a battery-charging rheostat panel, which is meeting with much approval amongst the trade on account of its "fool-proof" device and the protection which it affords against a careless person's running his cells by charging at too rapid a rate, or against the possibility of his cells discharging back into his charging generator.

The accompanying illustration shows this complete panel, consisting of a rheostat, overload and underload circuit-breaker, switch and fuses, with the hand lever of the rheostat so interlocked with the hand lever controlling the overload and no-current circuit-breaker, that it is impossible to close the circuit so as to pass the current through the battery, except when all of the resistance of the rheostat is in circuit. The resistance of the rheostat is built up of Ward Leonard enameled resistance units.

Marconi Company Wants Government Contract.

According to a Washington dispatch, dated June 30, the Marconi Wireless Telegraph Company has submitted a proposition to Rear Admiral Manney, chief of the Naval Bureau of Equipment, for furnishing wireless apparatus for communication between naval stations and ships of war in the Atlantic. It is supposed that this offer is intended as a counter proposition to that of the American De Forest Wireless Telegraphy Company, which was referred to in our last issue.

The Marconi Company, it is stated, proposes to equip a warship with its apparatus, or have a board of naval officers see how its service works on transatlantic liners, in order to test its merits in comparison with those of other wireless systems.

Visit of British Mechanical Engineers to Milwaukee.

The recent visit of the Institute of Mechanical Engineers of Great Britain to Milwaukee, in response to an invitation from the president of the Allis-Chalmers Company, was described by President Wicksteed, of the Institution, in his speech at West Allis, as "one of the pleasantest experiences that had come to the members during their American visit." "I do not know how these things are done," said he, "but this excursion has been perfectly managed. Two or three days ago in Chicago I met the president of this great company and incidentally remarked to him that I had long desired, as I knew many of my fellow members had, to visit the famous engine works in Milwaukee. President Warren asked: 'When will it be convenient for you and your fellow members to come?' and I replied, 'The day after to-morrow,' "and here we are, transported in some sort of a magical way, quietly, comfortably, without any apparent effort, by arrangements which can only have been made over night and yet are so admirably planned and carried out that they could not have been excelled had they been a long time in preparation. From the time we left the breakfast table in Chicago until we now return there in the evening, every movement has been thought out for us and every comfort provided. I want to say in behalf of the officers and council and members of the Institution that this is the kindest and most thoughtful and most generous thing that has happened in my experience of travel. This day, in one of the model engineering works of the world, is one that no member of our Institution now present will ever forget." President Wicksteed, Secretary Worthington and other members of the Institution said that in the way of industrial sights they had never seen anything more impressive than the huge erecting shop of the Allis-Chalmers Company, filled as it is with engines ranging from 30 hp to 12,000 hp in process of construction.

1,500-HP Motor-Starter With Automatic No-Voltage Release.

The accompanying cuts illustrate a motor-starter which, on account of its unusual capacity and the features embodied in its construction, is of special interest. The apparatus, recently built by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., is designed for starting a 1,500-hp, 500-volt motor at frequent intervals under full load, and it is probably the largest motor-starting rheostat ever constructed.

The starter has a plurality of switch levers mounted on a slate

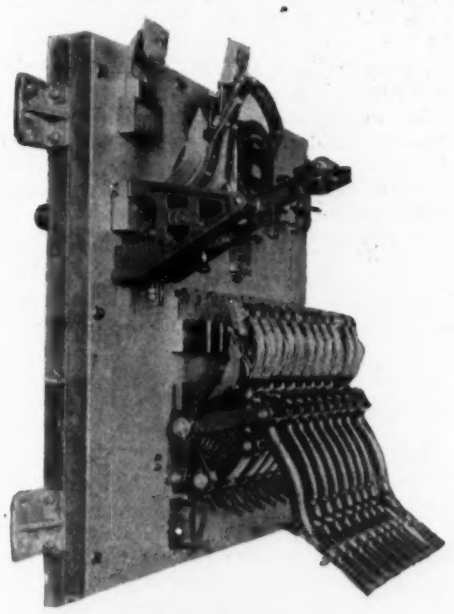


FIG. 1.—MOTOR-STARTER.

panel, each lever being used for cutting out a portion of the resistance, and it is similar in design to the well-known Cutler-Hammer multiple switch type. Each of the nine switches employed is quite similar to a circuit-breaker, having laminated leaf main contacts, an auxiliary copper bar contact, and a renewable carbon block for taking any arc which would be formed at this point, but the tripping coil is omitted. The switches are so interlocked mechanically that they can be closed only in their proper order. By use of the well-known Cutler-Hammer release device each switch is returned automatically to the starting position when the current supply is interrupted.

While it would be possible to construct a starter of the sliding-contact type for, say, a 1,500-hp motor, the apparatus would require a small motor to turn the rheostat lever. The multiple switch type obviates this difficulty and, moreover, affords protection by the automatic no-voltage release feature. For the sole purpose of reducing the sparking which occurs when moving a sliding contact from one segment to the next, the sliding-contact type of starter would call for a constantly increasing number of steps as the motor increases in size, while with the type shown the number of resistance steps used may be greatly reduced, due to the elimination of the sparking. With the usual sliding-contact type, there is nothing to prevent the operator from moving the starting lever with great rapidity, causing injury to the starter and the motor and drawing an excess of current from the line. With the present type, however, the numerous

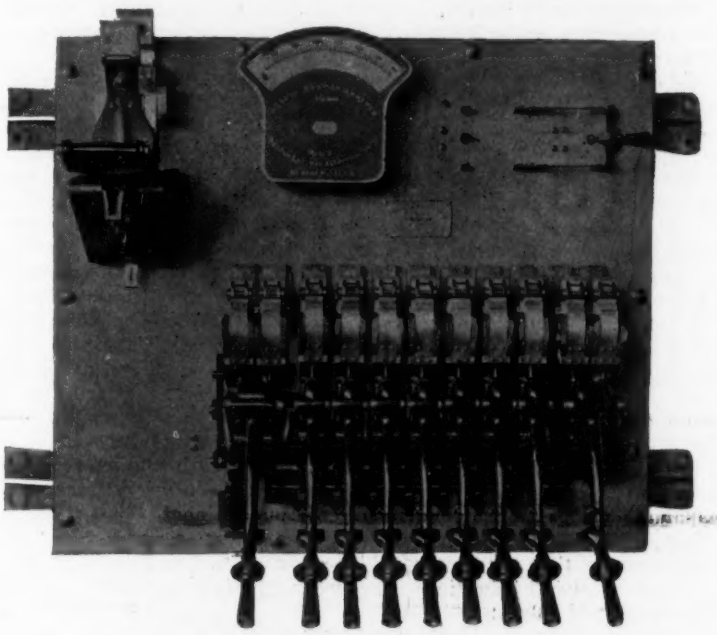


FIG. 2.—MOTOR-STARTER.

switches cannot be closed with sufficient rapidity to cause the flow of abnormal currents under normal load conditions.

In building starters of very large capacity it is the practice of the Cutler-Hammer Manufacturing Company to utilize iron pipe for the starting resistance, using water in the pipe to carry off the heat developed. The closing of the first switch opens a valve mounted on the back of the switchboard, and thereby admits water to the pipe. When the current is interrupted, the first lever flies open and closes the water admission valve and the last lever similarly opens the water exhaust valve, automatically placing all mechanism in position for another start.

The De Forest Wireless Telegraph System.

The St. Louis *Post-Despatch* of June 12 devotes considerable space to a description of tests on the De Forest wireless telegraph system. The tests were made between the De Forest wireless telegraph system. The tests were made between the De Forest tower at the World's Fair and the *Post-Despatch* building, about 4½ miles away. Although the transmitting waves have to pass through blocks of high buildings, many of which have steel framework, the service has been perfect. The recent tests of the De Forest system before the Government Wireless Telegraph Board have also been reported as highly satisfactory. It is stated that a rival system operated a powerful alternating-current transmitter only 15 miles from the naval station at the Highlands with a view to rendering the test worthless, but the attempt failed, messages being received from the warship *Topeka,* 75 to 100 miles distant, notwithstanding the disturbances set up.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Last week's trading was the lightest in four years, and the general market was apathetic. The feature was Metropolitan Street Railway. An advance of 5¼ points in this stock on Thursday was followed on Friday by a report that a plan for its amalgamation with the Interborough Rapid Transit Company was under way. Metropolitan Securities, also strong, advanced from 79½ to 84¾, and closed at 83⅝. In the curb market Interborough Rapid Transit advanced from 121¾ to 123, the high record for the stock. The story bearing on this advance in Metropolitan which gained the widest circulation was that the Interborough Company would secure control of the Metropolitan by means of a guarantee of 4 per cent. upon the stock of the Metropolitan Securities Company. Another report was that the Metropolitan Securities Company, on the stock of which only two installments have so far been paid, or 50 per cent. of subscriptions, would call in the remaining 50 per cent. from subscribers to the stock and that the $15,000,000 so obtained would be used for the benefit of the Metropolitan Street Railway Company. The sharp rise in Metropolitan was in most quarters set down as a sharp drive against a large short interest which has been built up in this stock. The prices ranged between 106¾ and 116¼, the closing quotation being 114⅜, a net gain of 6⅞ points. The total number of shares of this stock sold was 100,770. Brooklyn Rapid Transit did not show any sympathy with the movement in Metropolitan, there being an average trading at practically steady prices. The closing quotation was 49½, an advance of ⅞ point. The electric stocks were stronger with fair trading, and all closed with net gains. Allis-Chalmers preferred closed at 42½, an advance of 1⅜; General Electric at 157, a gain of 2 points, and Westinghouse common at 157, and preferred at 190, gains of 2¾ points and 1 point respectively. Western Union and American Telephone & Telegraph were both weaker, the former closing at 86⅞, a loss of ⅛, and the latter at 130¼, a net loss of 1 point. Except for two or three issues the curb market received slight attention, and although trading was light prices were well maintained. As already noted Interborough Rapid Transit was a feature, some of the activity in this stock being ascribed to the announcement that the road would be opened to the public on September 1, buying being induced thereby. Following are the closing quotations of July 5:

NEW YORK

	June 28	July 5		June 28	July 5
Allis-Chalmers Co.	8⅛	9	Electric Vehicle	9	8⅛
Allis-Chalmers Co. pfd.	42⅜	42¾	Electric Vehicle pfd.	12	12
American Tel. & Cable.	87	89	General Electric.	154	158
American Tel. & Tel	120	129	Hudson River Tel.	..	..
American Dist. Tel.	22	22	Metropolitan St. Ry.	109¼	115
Brooklyn Rapid Transit.	48⅜	49¼	N. Y. & N. J Tel.	..	..
Commercial Cable.	175	175	Marconi Tel.	..	..
Electric Boat	43	48	Western Union Tel	86⅛	87¼
Electric Boat pfd.	71	75	Westinghouse com	152	156
Electric Lead Reduction.	*⅜	*⅜	Westinghouse pfd	180	180

BOSTON

	June 28	July 5		June 28	July 5
American Tel. & Tel.	129¾	129	Western Tel. & Tel. pfd.	80	81
Cumberland Telephone.	112¼	112¼	Mexican Telephone.	1¼	*1⅜
Edison Elec. Illum.	239½	*245	New England Telephone.	*121	121
General Electric	153	156	Mass. Elec. Ry.	19	19¾
Western Tel. & Tel.	9	9⅛	Mass. Elec. Ry. pfd.	73	72

PHILADELPHIA.

	June 28	July 5		June 28	July 5
American Railways	45⅛	45⅛	Phila. Traction.	96¾	97⅛
Elec. Storage Battery	54	57	Phila. Electric.	6	5⅝
Elec. Storage Battery pfd.	54	57	Phila. Rapid Trans.	11¾	11¾
Elec. Co. of America	9	8⅞			

CHICAGO

	June 28	July 5		June 28	July 5
Central Union Tel.	..	..	National Carbon pfd.	101	101
Chicago Edison	..	142	Metropolitan Elev. com.	18⅛	18⅛
Chicago City Ry.	165	168	Union Traction	..	5
Chicago Tel. Co.	..	122	Union Traction pfd	..	25
National Carbon	28¼	..			

*Asked

BELL TELEPHONE ALLIANCES.—The belief is quite general in Boston and in Montreal that it is only a question of time before the American Telephone and Mackay companies form a close alliance to the mutual advantage of each, as it is figured that through such a union there could be effected a saving of one-third in expenses. An official in Boston of the American Telephone & Telegraph Company says: "The report that we are working with the Postal Telegraph Company is true, but it is a mere exchange of service here and there, and no significance can be attached to it, for we work in the same manner with the Western Union as with the Postal. When the Pennsylvania Railroad chopped down the Western Union poles along its lines some time ago, the Western Union business went over our poles to a very large extent. Many Western Union wires are now strung upon our poles and vice versa in different sections of the United States. Most of our sub-companies work with the two big telegraph companies in the extension and use of our lines as it is to their mutual advantage so to work, but there is no way in which this interchange of business and courtesies can be construed as forshadowing a consolidation of interests."

NEW YORK EXPRESS SERVICE.—An agreement has been entered into for the lease of the Metropolitan Express Company to the American Express Company for sixteen years. The Metropolitan is owned by the New York Transportation Company. It is a local express, handling freight and parcels in New York City and Westchester. It has large real estate holdings and a valuable contract with the Metropolitan Street Railway, by which its express cars are carried over the surface roads through Manhattan and the Bronx to the Westchester villages. The arrangement between the Transportation Company and the American Express Company includes the sale of the Metropolitan's equipment of horses, wagons and similar plant, but the ownership of its real estate and contract rights continues in the Transportation Company. The principal object served by the lease is the conduct of the express business, which has grown to large proportions, in harmony with one of the great railroad express companies instead of in competition with all of them. The new arrangement goes into effect on July 15.

NIAGARA FALLS POWER COMPANY'S OFFICERS.—At a meeting of the directors of the Niagara Falls Power Company, June 23, the following officers were elected: President, D. O. Mills, New York; first vice-president, Edward A. Wickes, New York; second vice-president and treasurer, William B. Rankine, Niagara Falls; third vice-president, George W. Davenport, Niagara Falls; secretary, Frederick L. Lovelace, Niagara Falls; assistant secretary and treasurer, W. Paxton Little, Niagara Falls; executive committee, D. O. Mills, John Jacob Astor, Francis Lynde Stetson, Edward D. Adams, Charles Lanier, F. W. Whitridge, all of New York, and Victor Morawetz, of Philadelphia. The same board of officers was elected for the Niagara Development Company and the Niagara Junction Railway Company, the executive committee for each of these allied concerns being D. O. Mills, Edward D. Adams, Charles Lanier, Francis Lynde Stetson and F. W. Whitridge.

BRAZILIAN TROLLEYS.—It has been decided to place the stock of the Sao Paulo Tramway Company upon an 8 per cent. dividend basis, an increase from 6 per cent. This is said to explain the recent advance in the price of the stock from 95 to 107. The Sao Paulo Company is only four years old, but it has made an enviable record. The $7,000,000 stock was given as a bonus with the bonds which were sold at 90, with the exception of $1,000,000 of it, which was sold last year at par, $100. The company controls the electric railway, electric light and power facilities of Sao Paulo, Brazil, which has grown in population in fourteen years from 50,000 to 280,000. Owing to cheap power and cheap labor, the Sao Paulo Company is able to operate upon a 31 per cent. ratio of expenses to income, and this ratio has been down as low as 27 per cent. The company is now showing net earnings of 10 per cent upon its stock. The enterprise is Canadian, with an American infusion.

DIVIDENDS.—The Hudson River Telephone directors have declared the regular quarterly dividend of 1½ per cent. The first quarterly dividend of 1½ per cent. on Third Avenue Railroad stock will be paid on July 30.

Commercial Intelligence.

THE WEEK IN TRADE.—In general trade and in the industries there is seasonable quietness, but the crop prospects give promise of a better condition. Reports received by *Bradstreet's* seem to confirm the earlier rather pessimistic reports as to general business. Bank clearings for six months will fall at least 14 per cent. behind a year ago, most of the decline being at New York, because outside of that city the decrease will not much exceed 4 per cent. Railway earnings in June took a turn for the better, and gross receipts will probably show a gain of 3 per cent. for the month, though decreasing 2 per cent. for six months. Reports of distribution vary in different sections and range from 5 to 15 per cent. below last year, accordingly as different lines of distribution are considered. Collections have been backward, in sympathy with the halting progress of retail trade. Railway building has been smaller than in 1903 or in recently preceding years. Half-yearly returns of insolvencies show

that liabilities have steadily decreased, each month recording smaller losses than the one preceding. Commercial failures for the week numbered 249, against 227 the week previous and 215 the corresponding week last year, these figures being from *Dun's Review*. Liabilities of commercial failures during June were $8,469,502, against $8,326,654 in June last year. A Chicago dispatch regarding business conditions in that section says: There has been no such volume of buying of goods in any line this year as marked the opening months of 1903. The net loss in sales by jobbers is 5 to 10 per cent. There are a few lines that have been able to hold their own, but they are by far the exception. Manufacturers have also lost in about the same proportion as the jobbers. It has cost more to sell goods, and the shrinkage in values has been greater, while wages have not decreased to any extent, and in some lines have increased. These conditions have naturally left prospects for profits less satisfactory. The one good feature in the situation is that collections have been up to the average. Confidence grows in the iron and steel industry, and while there is little support in the shape of increased orders, the amount of business in sight and contemplated work held back is sufficient to provide a good tonnage whenever it is decided that the time has come to place contracts. In the metals market copper ruled steady throughout the week. Exports continue on a large scale. The closing quotations are 12¼ at 12½c. for Lake; 12⅛ at 12⅜c. for electrolytic, and 11⅞ at 12⅛c. for cathodes and casting stock.

ELECTRICAL OPPORTUNITIES ABROAD.—Telephone lines are to be constructed from Madrid to the French border; from Madrid to Galicia via Santander; from Madrid to Malaga and Cadiz; from Vich to Manlleu; from San Vincent de Torello to Ripoll, and from Elche and Noveldo to Pinoso and Crevillente. For particulars, apply to Direccion general de Telégrafos, Madrid, Spain. Concessions have been granted for the building of the following electric lines of tramways: From San Cristobal de la Laguna to Tacaronto (apply to Société Anonyme des Tramways electriques de Teneriffe, Canary Islands); from Sevilla to Santiponce, Spain; and a line between Milan-Turin-Casteggio. Apply to Engineer Gredazzi, Milan, Italy. Several new electric tramway lines are to be built in Madrid, Spain, the permit having been issued by the Direccion general de Obras publicas, Madrid, which has also approved of the construction of an electric street railway in the city of Bilbao. The ministry of public works in Cairo, Egypt, will purchase a large quantity of telegraphic materials to be delivered at Suakim from October 1 to December 1 next. Among the supplies required are 220 miles' length of insulated wire, 6,000 insulators, wooden telegraph poles, etc. The breweries at Pilsen, Bohemia, will erect a large electric central station to furnish that noted industry with power. The Russian Ministry of Roads and Traffic has decided to operate a branch of the Baltic Railway by electric power. The municipality of Venice, Italy, has resolved to purchase electric motor boats. The city of Zanzibar, Africa, is to have an electric lighting plant; also an electric tramway line. For particulars apply to Hon. A. S. Rogers, the prime minister of the Sultan at Zanzibar.

4,000 HP PLANT FOR CUBA.—Important contracts will be awarded this month by the Cienfuegos, Palmira & Cruces Railroad & Electric Power Company for equipment to be installed in a hydraulic plant to be built at the Falls of Hababinalla, located about 30 miles from Cienfuegos, Cuba. The power will be used for lighting Cienfuegos, one of the most flourishing seaport towns on the island, and its suburbs. At Cienfuegos the local lighting company's interests have been taken over; 3,500 incandescent lamps is the extent of the present system. The new owners will install some 5,000 more, and will also put in 250 arc lamps for street lighting. The plant at Santa Clara, controlled by the Abren family, will also be taken over by the Cienfuegos, Palmira & Cruces Railroad & Electric Power Company, and the lighting system in that city will be considerably enlarged. The power plant will have an initial capacity of 4,000 hp, though ultimately it will be fitted with machinery, which will bring up the development to 10,000 hp. Contracts will now be let for three 1,000 kw generators direct-connected to water turbines. The available head is about 470 feet. There will be 9,000 feet of 36-in. steel pipe contracted for. Cuban and German capitalists control the company. Mr. Bruno Diaz, a wealthy Cuban tobacco exporter, is president of the company. Mr. Cornelius C. Vermeule, 203 Broadway, New York, is acting as consulting engineer for the undertaking.

1,000 HP PLANT FOR YAQUI MINE.— The Yaqui Copper Company, of which concern Mr. William Sauntry, of the Musser-Sauntry Log, Lumber & Manufacturing Company, of Stillwater, Minn., is president, and Mr. Henry Ide Wiley, chief engineer, has completed the plans for the erection of a large water power plant for operating a huge smelter and for driving drills and other machinery at Campo Santo Nino, State of Sonora, Mexico. The initial capacity will be 1000 hp, but ultimately it will be capable of developing at least 3,000 hp. Power will be taken from the Yaqui River which runs in heavy volume through the property. The plant will be about two miles from the smelter. The New York offices of the Yaqui Company are in the Broadway-Maiden Lane Building.

G. M. GEST, the expert subway contractor of New York and Cincinnati, was awarded last week a contract for the construction of a heavy 20-duct conduit system through Cincinnati, leading from the new exchange to the Fremont Avenue Exchange of the Cincinnati Bell Telephone Company. This has been necessitated by the tremendous increase of the telephone business in Cincinnati during the last year. Mr. Gest has also just been awarded a large contract for the construction of a conduit system through the lower part of Brooklyn, leading from the new power house of the Brooklyn Heights Railroad Company to their new sub-station. The same contractor was awarded a contract for the construction of an extension to the subway system of the Brooklyn Edison Company.

AMERICAN TRADE LITERATURE ABROAD.—A foreign engineer writes us that he finds it almost impossible to procure catalogues from American manufacturers. He says he has frequently written to firms advertising some ware that interested him, and while at times he has received an acknowledgment of his communication, he has not in a single instance received the catalogue or circular asked for. We hope this short-sighted policy is not so prevalent as the experience of our correspondent would appear to indicate.

EQUIPMENT FOR OFFICE BUILDING.—Orders are about to be let for equipment to be installed in a new 10-story office building at Binghamton, N. Y., for the Security Mutual Life Assurance Company. There will be a 13-in. x 12-in. horizontal simple automatic high-speed engine; also a 11-in. x 10-in. direct-connected to 106-volt generators of 60 kw and 40 kw capacity respectively. A storage battery will also be put in. Mr. Percival Robert Moses, of 35 Nassau Street, is consulting engineer in the work.

CURTIS TURBINES FOR P. R. R.—Curtis turbines will be installed in the power house to be erected in the terminal yards of the Pennsylvania Railroad at Greenville, Long Island. There will be two turbines of 500 kw capacity each. They will be direct-connected to General Electric dynamos. The equipment will be utilized for both light and power purposes. Mr. H. H. Maxfield, assistant engineer of the motive department of the Pennsylvania Railroad Company, has the matter in hand.

AUTOMOBILE FACTORY BURNED.—The big automobile factory of the Vehicle Equipment Company, at Thirteenth Avenue and Thirty-sixth Street, Brooklyn, has been almost totally destroyed by fire. The damage is estimated at $500,000. The company has made a specialty of electric trucks and delivery wagons. The company has recently had a strike to contend with. It is stated that the fire signal boxes nearby had been tampered with. It is also said a fire balloon started the fire.

EQUIPMENT FOR CARACAS PLANT.—More equipment will be ordered shortly by the Caracas Gas & Electric Light Company, Venezuela, of which Carlos Palacios, at one time connected with the old United Electric Company, of Newark, N. J., is the electrical engineer. The orders for additional machinery, etc., will be placed through Kates & Bok, whose New York offices are in the Orient Building, Wall Street.

POWER PLANT FOR AVINO MINES.—The Avino Mining Company, at Avino, State of Durango, Mexico, is about to put in a power plant of 400 hp initial capacity. Gas engines will be used to drive the generators. Mr. W. B. Jeffries is general manager of the company and Mr. Frank Fletcher, of Parral, Mexico, has been engaged to act as consulting engineer for the installation of the plant.

EQUIPMENT FOR LOCKPORT PAPER PLANT.—The United Box Board & Paper Company, Bowling Green Building, contemplates the purchase of about 1000 hp of electric equipment for one of its Lockport (N. Y.) plants now operated by steam power. The plant will be used for driving paper machinery. Water wheels will drive the generators.

PLANT FOR VIRGINIA COPPER MINES.—The New York & Virginia Copper Company contemplates the placing of orders for electrical equipment of about 1000 hp capacity for its plant in Floyd County, Va. The New York offices of the company are at 31 Nassau Street.

EQUIPMENT FOR CORDAGE WORKS.—The Lawrence Cordage Works, 46 South Street, will very shortly award contracts for electrical equipment for their plant, which will be of 300 hp capacity, including several motors.

General News.

THE TELEPHONE.

JASPER, ALA.—The Southern Bell Telephone & Telegraph Company is installing a new system here.

LITTLE ROCK, ARK.—The Southwestern Telephone & Telegraph Company has been granted the right to construct an underground system of wires in the city.

COLUMBUS, GA.—Automatic Telephone Company is enlarging its quarters here to make room for more selector boards. The company now has in the neighborhood of 1000 subscribers, and has met with much success in Columbus.

BOISE, IDA.—The Twin Falls Telephone Company, with a capital stock of $15,000, has been organized in this city. A system covering the entire Twin Falls country will be constructed.

DES MOINES, IA.—The State Board of Control has let the contract for a new telephone system for the state hospital for insane, at Cherokee, Ia., to the New State Telephone & Telegraph Company.

CHAMPAIGN, ILL.—The Home Telephone Company has increased its capital from $25,000 to $100,000.

WILLIAMSVILLE, ILL.—The Williamsville & Sherman Telephone Company has been incorporated with $2500 by Chas. M. Woods, Nathan Jussey and S. T. Jones.

CHICAGO, ILL.—The management of the Illinois Central Railroad Company is considering plans for the expenditure of approximately $400,000 for re-equipping its telephone system. The system consists of a telephone circuit of about 2000 miles, and the proposed re-equipment is the result of the failure of the system now in vogue, due to the use of too small wire. New wires, under the plan, will be strung between Omaha and Chicago and Chicago and New Orleans.

WILMOT, IND.—The Wilmot Mutual Telephone Company has been incorporated. Capital, $10,000. Directors: L. R. Gerald, H. T. Cline and others.

TERRE HAUTE, IND.—The Citizens' Telephone Company, of this city, has completed its extension to Lewis and is contemplating other extensions and improvements.

SOUTH WHITLEY, IND.—The Farmers' Mutual Telephone Company has extended its line to Laurel and added 100 village subscribers to its list. Other extensions are now being planned.

MEDFORD, IND.—The Mt. Pleasant Telephone Company has completed its system which is now in operation. The company has over a hundred farmer patrons and nearly 60 town subscribers. It will have two trunk line connections with Muncie.

FULTON, IND.—At the recent annual meeting of the directors of the Fulton Telephone Company the following officers were elected: President, George Rentschler; secretary and superintendent, H. L. Becker; treasurer, E. E. Jackson.

MICHIGAN CITY, IND.—The Merchants' Mutual Telephone Company, of this city, announces that it will at once begin the work of overhauling and reconstructing its entire system. The company will expend between $15,000 and $20,000 in betterments.

EVANSVILLE, IND.—The Evansville Telephone Company must show its books, papers and subscription list, etc., according to the decision of E. A. Ely, sitting as special judge in the case of Edward Meyer against the company for a receiver. The officials are given ten days in which to comply with the order of the court.

OXFORD, MICH.—The Oxford Valley Telephone Company, of Oxford, has been incorporated with the Secretary of State, and is preparing to organize and place in operation a system of telephones for the accommodation of the residents of the Oxford valley.

GLENCOE, MINN.—The Norwood-Young America Telephone Company will build a line here.

OWATONNA, MINN.—The Merton Rural Telephone Company has been organized here with L. D. Carleton as president.

WADENA, MINN.—The Minnesota Central Telephone Company may rebuild the local exchange this season.

MINNEAPOLIS, MINN.—The Northwestern Telephone Company will build a new line from Minnepaolis to Hammon Station.

TUSCOLA, MO.—The Tuscola Telephone Company has increased its capital from $25,000 to $100,000.

SENATOBIA, MISS.—The Tate County Telephone Company, capital $1000, has been incorporated.

CUSHING, NEB.—The Cushing Independent Telephone Company has been incorporated with $50,000 capital stock.

RENO, NEV.—The entire system of the Sunset Telegraph & Telephone Company in this city, and at Sparks, is to be rebuilt at a cost estimated at $30,000.

EAST RANDOLPH, N. Y.—The East Randolph Telephone Company has been incorporated, capital $10,000, by Rollin Dow, Nellie Dow, Isa D. Dow, all of East Randolph.

MORGANSVILLE, N. Y.—The Stafford Telephone Company, of Morgansville, capital $3000, has been incorporated by Jas. Lathrope, Jas. Wright, W. S. Daniels, all of Morgansville.

AUBURN, N. Y.—The Cayuga & Seneca Telephone Company, of Auburn, has been incorporated by E. Clarence Aiken, Frederick A. Mohr, Howard W. Fluhrer, all of Auburn.

OSWEGO, N. Y.—The Empire State Telephone & Telegraph Company has awarded the contract for building its subway in this city to the Barnett Contracting Company, of this city.

BABYLON, L. I., N. Y.—The New York & Long Island Telephone Company, whose line extends from Jamaica to Babylon, has been swallowed up by its old-time foe, the New York & New Jersey Telephone Company. The transfer took place June 25, the terms being private, but it is understood were very satisfactory to the stockholders of the New York & Long Island. The company was capitalized at $100,000. It was the legitimate successor of the South Shore and Seaboard companies, whose franchise extended into the city limits, and was granted before the enactment of the law which prohibits a Board of Aldermen from granting a franchise for a longer period than twenty-five years. The New York & New Jersey people did not purchase directly, but are nevertheless the real owners of the old line.

CHARLOTTE, N. C.—The Southern Bell Telephone Company has bought out the entire plant of the Charlotte Telephone Company, and the two systems will be merged, putting the Bell in complete control. The manager of the Bell Company does not think that any increase in rates will be made. The Bell has recently made extensive improvements in its Charlotte plant, putting the wires underground.

DAYTON, ORE.—The Yamhill County Mutual Telephone Company has been incorporated with a capital stock of $3000. The directors are J. W. Martin, J. E. Mellinger and others.

GREYSTONE, TENN.—The Greystone Telephone Company, of Greene County, capital stock $500, has been incorporated by Hardie Johnson, Wiley McCoy, Sparling Bowman, George McCoy, Dan McCoy and C. W. Allen.

AUSTIN, TEX.—The Central Telephone Company, of Ben Wheeler, Van Zandt County, capital stock $5000, has been incorporated by W. J. Stewart, A. J. Adboui, J. A. Reynolds.

BROWNSVILLE, TEX.—The Brownsville Telephone Company, of Brownsville, has been incorporated with a capital stock of $10,000. The incorporators are James B. Wells, Baldwin G. Steyman and Frank W. Kibbe, all of Brownsville.

MECHANICSBURG, VA.—The Mechanicsburg Telephone Company has been incorporated; capital, $5000. J. Dutton is president.

CHIPPEWA FALLS, WIS.—The Melville Settlement Telephone Company has been formed in the town of Lafayette to build a rural line.

ELECTRIC LIGHT AND POWER.

LOS ANGELES, CAL.—The plant of the Mentone Power Company, a branch of the Pacific Light & Power Company, is nearing completion in Santa Ava Cañon. The plant when completed will represent an investment of $25,000. It will supply power principally to Pasadena and Los Angeles electric railweys.

MERIDEN, CONN.—The Meriden Electric Light Company is installing a direct-connected unit consisting of a 380-hp Westinghouse engine and 200-kw generator.

WASHINGTON, D. C.—The Potomac Electric Power Company has recorded a mortgage on its property to secure an issue of $4,000,000 of 5 per cent. bonds, payable in 25 years. It is explained that the money will be used for improving the plant and for other betterments. While present plans do not contemplate the expenditure of the entire sum, it was thought best in making the loan to have it sufficiently large to cover any future contingencies.

TAMPA, FLA.—One of the most important and far-reaching movements in the industrial development of south Florida is now practically under way. The waters of the Withlacoochee River are to be harnessed and electric power generated for the operation of the great phosphate plants and mills in Citrus, Marion and Levy counties. The Camp Phosphate Company will at once begin the construction of the great dams on the river near this point. It will not only supply power for its own plants and mills, but for other corporations and manufacturing establishments, and electric lighting for adjacent towns and cities.

GAINESVILLE, GA.—The big dam of the North Georgia Electric Company, which has been nearly two years in building, has just been completed. It is located on the Chattahoochee River, near Gainesville.

LA GRANGE, GA.—The town of LaGrange will hold an election on the question of issuing bonds for an electric light plant for the town, and a committee has been named to investigate other plants and report.

ELBERTON, GA.—There are indications that the Calhoun water power on the Savannah River near Elbetron will soon be developed, as parties have recently been on the field to abstract titles. Application will be made to the next Legislature for the right to dam the river at a point 12 miles from Elberton.

BOISE, IDA.—Articles of incorporation have been filed here by the Crane Falls Power, Transportation & Development Company, of this city. The company has a capitalization of $5,000,000.

BOISE, IDA.—Articles of incorporation of the Idaho Consolidated Power Company, representing a consolidation of the Bonanza Land, Power & Light Company, the American Falls Power, Land & Light Company and the Tarbet Company, all of which have large interests at American Falls, Ida., have been filed under the laws of the State of Wyoming. The merged companies have a capitalization of $2,000,000. The power to be utilized by the consolidated company will be transmitted over a wide area, covering southeastern Idaho and parts of Montana and Utah. Extensive improvements will be made under the new management. The officers of the new corporatien are A. H. Tarbet, of Salt Lake, president; J. H. Brady, of Pocatello, general manager; D. W. Stanrod, of Pocatello, treasurer, and W. S. Chaney, secretary.

DUBUQUE, IA.—The Union Electric Company plans to extend its lines.

PELLA, IA.—It is reported that the city may install a new electric light plant.

DES MOINES, IA.—The Iowa Light & Heating Company will make extensive additions to its plant. About $100,000 will be expended.

GIBSON CITY, ILL.—The Gibson Electric Light & Power Company, of Gibson City, capital $30,000, has been incorporated by L. J. Hiland, S. J. Lefevre and A. L. Phillips.

TULSA, IND. TER.—The Tulsa Water, Light, Heat & Power Company, of Tulsa, has been incorporated; capital, $120,000. John Dermott, president; George B. Bayne, secretary.

CAVENDISH FALLS, VT.—A prospective power company with plant to be located at Cavendish Falls for the transmission of electric current for power and lights, is canvassing the community with a view to launching the enterprise.

FRONT ROYAL, VA.—W. J. Kendrian, Village Recorder, writes that it was voted June 14 to issue $15,000 in bonds for an electric light plant.

OPELOUSAS, LA.—Knox, George & Company, New Orleans, have been selected by this city to make a full investigation of the present operation of the water works and electric light plant, with a view to general overhauling and installing some new apparatus.

BELFAST, ME.—The Belfast Gas & Electric Company, of Portland, will increase its capital from $100,000 to $115,000.

CLINTON, ME.—The Clinton Electric Light & Power Company has recently been incorporated and received a charter. F. L. Besse has been chosen president and M. Morrison secretary and treasurer.

TOWSON, MD.—The County Commissioners have awarded to the Baltimore County Water Electric Company the contract for supplying electric arc lights at Canton, Highlandtown and elsewhere at $90 a year for 5 years, and incandescent lights at $22.50 per year.

BELAIR, MD.—The Glencove Power Manufacturing & Supply Company, of Harford County, has organized and elected the following-named officers: President, Charles A. Andrew; secretary and treasurer, James T. Jones. Charles H. McComas was elected attorney for the company, and the incorporators were chosen as directors for the first year. The company is authorized under its charter to generate and supply electric current for all purposes. It is also authorized to build and operate steam or electric railways within the limits of Harford County.

ST. IGNACE, MICH.—The electric light and water works of this city were burned on June 22.

ITHACA, MICH.—The citizens have voted to issue $13,000 in bonds for building and equipping an electric light plant.

NEW ALBANY, MISS.—An election will be held soon on the question of constructing an electric light plant. E. M. Owen is city clerk.

BOONEVILLE, MISS.—The Citizens' Electric Light & Telephone Company is to construct an electric light plant at a cost of $10,000.

MACON, MISS.—The citizens have voted to issue $12,000 in bonds to purchase the electric light plant of N. Scales and re-equip it.

BOGOTA, N. J.—Bogota Water & Light Company, of Bogota, Bergen County, has filed a certificate increasing its capital from $10,000 to $20,000.

LEXINGTON, N. C.—Bids are wanted Aug. 1 for $61,000 in bonds for an electric light plant, water works, etc. John H. Mayer is Mayor.

OXFORD, N. C.—The town of Oxford has voted electric lights and water. The plant will be owned by Edwin I. Frost, of Salisbury, N. C., and the town will pay $3500 annually for the service.

ASHEVILLE, N. C.—The W. T. Weaver Power Company, utilizing the power of the French Broad River at Asheville, is now supplying power to the Biltmore estate of Mr. Vanderbilt. The company has been successful in getting contracts to furnish power to former steam plants in the city.

RENO, NEV.—The Washoe Power & Development Company has decided to order all necessary equipment and machinery for the plant, so that it may be operated within six months. Definite action is delayed pending the receipt of a report from the company's engineer.

RENO, NEV.—The Reno Power, Light & Water Company is engaged in the construction of two large reservoirs, the larger of which will have a storage capacity of 60,000,000 gallons and the smaller a capacity of about half that amount. The expense already incurred in construction work approximates $50,000. The company plans the construction, at some future period, of another reservoir of a still greater capacity. Bonds to the amount of $750,000 are to be issued by the company for the improvement and enlargement of the system.

COATESVILLE, PA.—The Coatesville Consumers' Electric Light, Heat & Power Company, of Coatesville, has been incorporated with a capital of $20,000.

WILLIAMSPORT, PA.—Bids will be received July 29 by the Light and Water Committee of the City Council for lighting streets, etc., for a period of 5 or 10 years from Dec. 1, 1904, with either gas or electricity. J. J. Galbraith is City Clerk.

LANCASTER, S. C.—The town of Lancaster is discussing the question of voting bonds for a municipal lighting plant. There is also talk of securing the power from a local cotton mill.

BATESBURG, S. C.—Bids are wanted for $20,000 in bonds for an electric light plant and water works. Address W. H. Timmerman, Chairman of Commissioners.

KNOXVILLE, TENN.—The Lighting Commission has presented its report to the Council recommending that the city build and operate its own electric light plant. The probable cost is $137,000.

MARTINSVILLE, VA.—The Town Council is stated to have purchased the water power at Hairston's Mill owned by Col. Peter Hairston. This will insure either the partial or full development of the power at this point in the near future and the lighting of the town by electricity.

BELOIT, WIS.—The Beloit Electric Company, of Beloit, has secured the contract for street lighting for 10 years at $65 per light per year for 100 lights to burn until 1 o'clock and $85 per light for 10 lights to burn all night.

THE ELECTRIC RAILWAY

MIDDLETOWN, DEL.—The Middletown & Cecilton Railway Company has been granted a franchise by the County Commissioners of Cecil County for an electric railway between Middletown, Del., and Frederickstown on the Sassafras River.

ATLANTA, GA.—The projectors of an electric railway from Atlanta to Anderson, S. C., met in Atlanta recently and took steps for another survey of the proposed route. The line has been chartered by the Secretary of State, and the men at the head of the company have already had a route surveyed. The line is to be 140 miles long, and will connect at Anderson with a trolley line from Greenville, making the whole line 165 miles in length. This will be the longest electric line in the South. Among those present were J. R. Hosch, W. P. DeLaperriere, J. E. Hill, H. J. Sell, J. H. Lott, R. A. J. Hosch and A. C. Hosch, of Hoschton, Ga.; G. R. Dortch, Mr. Little and Mr. Rampy, of Carnesville, Ga.; Dr. W. C. Pirkle, T. C. Flanagan and J. M. Williams, of Auburn, Ga.; A. J. Almand and Julius C. Johnson, of Lithonia; J. A. Campbell, of Centerville, Ga.; Mr. Sawyer and Mr. Langford, of Snellville, Ga.; W. K. Sharpe, of Townville, S. C., and Dr. Coghman and others, of Anderson, S. C.

CHICAGO, ILL.—The Chicago & Milwaukee Electric Railway Company has taken out incorporation papers in Wisconsin, presumably for the purpose of extending its present road north of the Illinois-Wisconsin line.

BELVIDERE, ILL.—John M. Roach, president of the Chicago Union Traction Company, is interested in the construction of an electric railway from Belvidere to Elgin. The company will purchase a private right of way.

SPRINGFIELD, ILL.—The stockholders of the Springfield, Lincoln, Bloomington & Peoria Electric Railway Company have decided to increase the capital stock of the company to $300,000, and to commence work on the line as soon as the right of way and a franchise are secured.

DECATUR, IND.—Work has begun here on the principal power house, and the car house and machine shops of the Fort Wayne & Springfield Interurban road. The roadbed is now graded from Fort Wayne to this city. It is the purpose to have cars running late this fall.

DANVILLE, IND.—The promoters of the Indianapolis, Danville & Rockville Interurban Railway are pushing the work of construction. Some difficult engineering problems have had to be met, among them a number of fills from 300 to 900 ft. long, the construction of 30 concrete arches, and half a dozen substantial bridges. A number of subways are being built through which the country travel will go. These are made by cement arches being constructed 15 ft. high and 20 ft. wide. It is thought the line will be ready for operation by Thanksgiving.

JEFFERSON CITY, MO.—The St. Joseph Interurban Railway Company has been chartered with a capital stock of $100,000. The incorporators are George C. Simms, Alice Butler, Samuel F. Moore, James E. Patrick and John J. Lea.

ANOKA, NEB.—An electric railway is projected from this place to Springview. Water power will be developed near Butte, Neb. C. A. Johnson, of Butte, is interested.

ELIZABETH, N. J.—The Elizabeth & Raritan River Electric Railway has made a mortgage to the Fidelity Trust Company, of Newark, as trustee, to secure $2,500,000 of general mortgage 5 per cent. bonds, due May 1, 1954. Of these bonds $500,000 have been issued and are outstanding, $1,000,000 are reserved for improvements, and the remainder are reserved to retire at or before maturity an equal amount of bonds of the constituent companies, and also $75,000 notes of the East Jersey Street Railway. The new general mortgage covers 60.78 miles of road.

NEW YORK, N. Y.—It is said that the Belmont syndicate will begin the construction of a tunnel to connect Long Island City and Manhattan at a point near Forty-second Street. The franchise for this tunnel was granted to the Inter-Island Construction Company in 1892, and title to it was acquired by the Belmont syndicate in 1903.

LIBERTY, N. Y.—The Liberty & Jeffersonville Railway Company, which plans to build an electric railway from Liberty to Jeffersonville, is anxious to hear from contractors who would be willing to finance and build the line. William P. Craig, Oakwood Court, Orange, N. J., may be addressed.

SCHENECTADY, N. Y.—It is reported that the trolley lines owned by the Schenectady Railway Company will be sold to the New York Central and the Delaware & Hudson Railroad companies, and that the trolley company will clean up $1,000,000 by the transfer. The traffic of the New York Central between this city and Albany, Troy, Amsterdam and all other nearby towns and the traffic of the Delaware & Hudson from Schenectady to Ballston and Saratoga have been seriously encroached upon by the lines of the Schenectady Railway Company.

NEW YORK, N. Y.—The Board of Rapid Transit Commissioners has approved the application of the New York Connecting Railroad Company for a franchise. This company is backed by the Pennsylvania R. R. Co. and the New York, New Haven & Hartford Railroad Company. Its purpose is to accomplish the easy transfer of freight between the termini of the two lines. The route projected is from Greenville, Jersey City, by ferry to South Brooklyn, thence over the tracks in the possession of the Pennsylvania Road to Ridgewood, and from there by viaduct to the East River, thence by bridge 135 ft. high across the river and Ward's and Randall's Islands. The tracks will reach the Mott Haven yards of the New York, New Haven & Hartford road. The Federal authorities have already given the permit for the bridge.

EL RENO, O. T.—An ordinance for the construction of a street railway, to be built by John A. Goodwin, has been introduced at the meeting of the City Council.

WOODSTOCK, ONT.—The Woodstock Electric Railway, Light & Power Company will let contracts immediately for water-wheels, generators, etc., in connection with proposed power development.

WALKERVILLE, ONT.—A thirty-year franchise has been granted by the Walkerville Council to the Ontario Traction Company for its proposed line from Windsor to Tecumseh.

HARRISBURG, PA.—The Harrisburg Traction Company has secured the right of way to build from Paxtang to Hummelstown.

HARRISBURG, PA.—Charters have been issued by the State Department to the Carnegie, McDonald & Canonsburg Street Railway Company, to build a line 18 miles; capital, $10,000; W. J. Brennen, president; W. F. Johnson, J. S. Willard, L. R. Lewis and others, directors; the Westmoreland County Passenger Street Railway Company, to build a 10-mile line from Latrobe to Greensburg; capital, $60,000; Joseph Keeling, Pittsburg, president; Joseph Keeling, Frank W. Jarvis, E. C. Gerwig and others, directors.

CHARLESTON, S. C.—Interests identified with the Charleston Consolidated Railway, Gas & Electric Company have chartered the Carolina Development & Construction Company, of Charleston, S. C., for the purpose of developing water powers in this State and the transmission of energy to manufactories. The company has organized as follows: P. J. Balaguer, of Charleston, S. C., president; E. W. Wynne, of Charleston, S. C., vice-president; F. K. Myers, of Charleston, S. C., secretary and treasurer; W. W. Fuller, engineer; M. Rutledge Rivers, of Charleston, S. C., general counsel; P. J. Balaguer, E. W. Wynne, B. A. Hagood, W. G. Green, J. H. Dingle, J. Lamb Perry, C. F. Middleton, G. M. Politzer, F. K. Myers, directors.

NEW INDUSTRIAL COMPANIES.

THE SIMMONS-MOORE MANUFACTURING COMPANY, of Columbus, Ohio, capital stock, $100,000, has been incorporated to manufacture electrical machinery. The incorporators are W. F. Moore, S. T. Simmons, M. L. Walker, E. E. Moore, J. M. Butler and others.

THE GEORGE WEIDERMAN ELECTRIC COMPANY, of New York City, capital $15,000, has been incorporated. Directors: George Weiderman, C. T. Ellis and T. H. Cooper, of Brooklyn.

THE UNIVERSAL ELECTRIC SUPPLY COMPANY, of Chicago, capital $2500, has been incorporated to manufacture machinery. The incorporators are C. J. Holland, N. F. Higgins and L. H. Fisher.

THE ACME WIRE COMPANY has been incorporated at New Haven, Conn., to manufacture wire and electrical apparatus. The capital stock is $100,000. the incorporators being Victor M. Tyler, of New Haven; H. E. Flather, of Rome, N. Y., and Edgar L. Haitpence, of Newark, N. J.

THE TRITT ELECTRICAL MANUFACTURING COMPANY has incorporated at South Bend, Ind., for the purpose of manufacturing electrical specialties. The incorporators are B. E. Tritt, A. H. Calvert and Charles H. Kreighnaun. The company's capital is $15,000.

LEGAL.

THE ORANGE COUNTY GAS & ELECTRIC COMPANY, of Middletown, N. Y., has been placed in the hands of a receiver by Judge Blanchard, of the Supreme Court, who appointed George A. Swayze, of Middletown, receiver on the application of Henry Floy, on a judgment against the company for $10,766 for salary and money advanced.

WIRELESS LITIGATION.—Mr. John Bottomley, secretary and treasurer of the Marconi Wireless Telegraph Company of America, has been interviewed with regard to two suits brought against the company by the De Forest Company and by Henry Gardiner, a stockholder. Speaking of Gardiner's suit Mr. Bottomley said: "The allegations of insolvency contained in the complaint of Gardiner are ridiculous and preposterous on the face of them. The Marconi Wireless Telegraph Company of America owes no debt of over $100, on open account, and there is a large surplus in bank. Its aggregate debts are of an insignificant amount for current accounts. I have been with the company since it was formed, and I say, absolutely without fear of contradiction, that no one as a director or officer of this company has ever used or attempted to use, or is to-day using or attempting to use, or has access to any of the resources of the company for his own benefit, notwithstanding Mr. Gardiner's allegation to that effect. No shares of this company have ever been given to any Director by this company, nor has there been waste or mismanagement. On the contrary, economy and conservatism have been and are the rule." The De Forest suit alleges libel and misrepresentation on the part of the Marconi Company concerning the recent De Forest contract with the Navy.

OBITUARY.

MR. F. E. MacMAHON.—A cable dispatch from London of July 5 says: "F. E. MacMahon, an American, died suddenly at Newmarket to-day. He served in the War of the Rebellion and was with Admiral Farragut at the capture of New Orleans. He invented the tape ticker, the utility of which was first demonstrated publicly by sending the news of the winning of the Derby by Iroquois, in 1881, from the course to the cable office. On this occasion, Mr. MacMahon explained the mechanism to King Edward, who was then the Prince of Wales." This close identity of Mr. MacMahon with the stock ticker is rather new.

PERSONAL.

T. SAIGA.

MR. T. SAIGA, director of the Iyo Hydroelectric Power Plant, described elsewhere in this issue, has been a prominent factor in Japanese electrical engineering development. He entered into professional work 16 years ago as an engineer of the Miyoshi Electric Company, at Tokio. During his service of seven years with this company he superintended the construction of the Kyoto electric railway, the first Japanese electric line. Since then he has been located in Tokio, carrying on work for himself. Among notable work has been the construction of the Hoshu electric railway, the lighting plants at Danuki, Tosa and Miyagawa, and those of the Tokio and Osaka stock exchanges, and the Osaka Kabuki theatre, as well as electric power plants for the Bessi copper mine and the Kanada coal mine. In addition to the Iyo plant he has constructed hydroelectric plants at Hiroshima, Matsuki and Kakata, the latter operating under a head of 550 feet. He is at present preparing plans for three electric railway and five water-power plants, having recently taken up the exploitation of water powers, which are numerous in Japan. Mr. Saiga is the inventor of a rail bond much used in Japan.

MR. OTTO SCHEILER, a German electrical engineer, arrived by the *Deutschland* last week to introduce his wireless telegraph system which, he states, he has been asked to show to the Government authorities.

MR. FRANK W. FRUEAUFF has been appointed general manager of the Denver, Col., Gas & Electric Company. This gentleman is well known in the lighting field, and contributed at the last meeting of the National Electric Light Association a much-appreciated paper on accounting, printed recently in these columns.

MESSRS. PORTER AND BLOSSOM, of Sanderson & Porter, 52 William Street, New York, are back from a trip to New Orleans, where they went in connection with the large proposed power house extension for the New Orleans Railways Company.

MR. F. S. HUNTING, the treasurer and sales manager of the Fort Wayne Electric Works, has sustained an irreparable loss in the death of his wife, Mrs. Harriet Alzina Hunting, who had been ill for some months. Her death occurred at Chicago on June 26, and the funeral took place two days later at their home in Fort Wayne. Three young sons share their father's bereavement.

MR. O. A. SANDBORGH, of the Westinghouse railway department at Pittsburg, has been engaged recently on some important and interesting work in installing the West Side elevated road at Chicago with the multiple-unit control system. The road has been hitherto of the electric locomotive type with a motor car and several trailers; but it is found that such service is not adequate to the growing traffic. Mr. Sandborgh has been in New York on his way home.

MR. HARRY R. KING, designing electrical engineer of the Western Electric Company, of Chicago, was married on June 21 at Leadville, Col., to Miss Irene Baker. Mr. and Mrs. King will remain in Colorado for their honeymoon, spending a few weeks in the mountains near Rifle. Mr. King has been connected with the engineering department of the Western Electric Company for several years, during which time he has formed a very wide acquaintance among the electrical interests of Chicago.

MR. GEORGE CAMPBELL, president of the Germania Electric Lamp Company, of Harrison, N. J., returned to America this week after a few weeks' absence abroad. The purpose of his trip was to arrange an agency in Great Britain for the Germania lamps. The trip was made because inquiries and orders received from England seemed to indicate a successful one in that he has not only secured a progressive representative, but he is able to return himself with lamp orders.

PROF. D. C. JACKSON and members of his family while out driving at Madison, Wis., on July 1, met with a shocking accident, resulting in the death of his mother, Mrs. Josiah Jackson of Pittsfield, Mass., and severe injury to himself, wife and a guest. Owing to a fainting spell of Prof. Jackson, who was driving, the team ran away and the carriage colliding with a tree, all of the occupants were dashed out. The mother was killed, Prof. Jackson and his wife each had an arm broken, and Mrs. Erastus Milo, widow of the former president of Fiske University, who was visiting the home of Prof. Jackson, was badly injured.

MR. CHARLES J. GLIDDEN, accompanied by Mrs. Glidden, after an absence of over a year, arrived at New York on the steamer *Deutschland* on June 30. They are making a tour of the world in an automobile, and have already covered 16,200 miles. They will leave Boston in August and journey to San Francisco, whence they will take ship to Hawaii and the Philippines. They will then go to Asia. They expect to complete their trip in 1907, and estimate that they will then have traveled in their auto about 40,000 miles. The automobile used in their globe-encircling trip will, it is said, be exhibited at the St. Louis Exposition during the latter part of August.

MR. O. H. ENSIGN, electrical and mechanical engineer of the Edison Electric Company of Los Angeles, Cal., has been appointed consulting electrical engineer of the U. S. Reclamation Commission, and is now on a trip of two months throughout the states of the arid West in company with Chief Engineer Newell, of the Commission. Mr. Ensign's special duty on this trip will be to investigate and report on the feasibility of hydro-electric power development in connection with the many hydraulic works which the Commission has under way or are contemplated, a task for which he is especially qualified by reason of his long and successful experience in developing the water-power plants of the Edison Electric Company, with which Mr. Ensign retains his connection.

Trade Notes.

F. BISSELL COMPANY, 226 Huron Street, Toledo, Ohio, is now distributing its new price book of 466 pages—one of the largest and most complete ever issued by an electrical house.

GARVIN MACHINE COMPANY, Spring and Varick streets, New York, has just issued a neat little pamphlet illustrative and descriptive of its metal-working machine tools. It is 16mo size, in small type, and contains nearly 300 pages. Many of the descriptions are very full and elaborate, giving technical value to the catalogue quite aside from its trade features.

CABLE TROLLEYS.—We are informed by F. Bissell Company, of Toledo, Ohio, that an arrangement has been made by which the W. G. Nagel Electric Company has sold to the Bissell concern its patent on cable trolleys, all merchandise and good will in connection therewith. This, it is said, makes the F. Bissell Company the exclusive manufacturer of such trolleys.

INSULATING MATERIALS.—The H. W. Johns-Manville Company, New York, has just issued a neat and complete catalogue covering "Mica" plate, cloth, segments, rings and mica in all their various forms required by the electrical industry, also "Vulcabeston," "Transite," "Electrobestos" and "Niagrite." A copy can be had by addressing the company, 100 William Street, New York.

INTERCOMMUNICATING TELEPHONES.—The Connecticut Telephone & Electric Company, of Meriden, reports very large sales of its automatic intercommunicating telephone, which is now fitted for branch office exchanges with connection to city service, and is adapted either for connection to local or common battery systems. The company has issued a bulletin describing this instrument, which will be sent on request.

SAFETY INSULATED WIRE & CABLE COMPANY, 114 Liberty Street, New York City, has just issued a handsome illustrated catalogue which contains considerable data on submarine cable work it has done throughout the world—in Mexico, the Philippines, etc. The pamphlet embraces also various engineering tables of current value and interest to all users of wires and cables. Several well-known buildings are shown that have been fitted with Safety wire and cable.

ANOTHER USE FOR BLOWERS.—The May 28 issue of ELECTRICAL WORLD AND ENGINEER gave an interesting description of the electric church organ which was recently installed at the First Church of Christ, Scientist, in Denver, Col. This organ is one of many having the air for blowing supplied by a Sturtevant blower. The blower is electrically driven, the apparatus being located in the basement of the church, and is connected with the organist's switchboard so that he may start the blower without leaving his seat.

LINK-BELT ENGINEERING COMPANY, Nicetown, Philadelphia, has just issued, for 1904, another neat edition of its booklet on the Renold silent chain. It is entirely new as to illustrations of the recently patented bushed type chain, shown on page 4; and the reading matter has been rearranged. As to the chain, it may be stated that by transferring the wear from the hole of the link to the case hardened bushing, the chain is practically "non elongation." Another booklet of recent Link Belt origin is one devoted to "Retail Coal Pockets."

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, in Bulletin 3053, describes and illustrates an engine laboratory lathe for alternating current. This consists of a motor, on either end of the shaft of which are attached tools such as are used to perform all the light polishing and grinding required by dentists and jewelers. Each end of the shaft is fitted for a Ritter tool chuck. The motor is a simple induction motor measuring only 6½ inches in length by 6 inches in diameter, but guaranteed to develop 1-10 actual horse-power. On a 60-cycle circuit the motor operates at approximately 3400 r.p.m.

"THE BUCKEYE ENGINE" is the name of an admirable pamphlet just issued by the Buckeye Engine Company, of Salem, Ohio, and devoted to its product in the line of steam prime movers. It is a handsome oblong pamphlet of 125 pages, beautifully printed on rich paper and illustrated by a large number of choice line and half tone engravings. The Buckeye works were established in 1847, and the evolution of the product since that period is duly traced. The bulk of the space is devoted to the latest and most modern types of engine built by the concern, simple and compound, belted or direct connected, horizontal and vertical; as well as to the types of governor. Several pages of well-written, closely-reasoned text deal with the features of these engines, in theory and practice.

THE SCRANTON BUTTON COMPANY, Scranton, Pa., is having a large and ever increasing demand for telephone mouthpieces, receiver shells, bushings and special insulating devices. This company has found it necessary to increase its capacity for manufacturing moulded insulations. A finely equipped factory with special machinery and skilled workmen enables it to meet the demands of the trade. It is steadily maintaining the grade of its product, irrespective of the high price of raw material. The electrical manufacturing trade has shown its appreciation by placing large orders and supplementing them with reorders. The United Button Company, of 692 Broadway, New York, and 198 Jackson Boulevard, Chicago, is its sole agent.

LONG DISTANCE TRANSMISSION.—One of the most interesting maps ever issued in the electrical field is that just sent out by Mr. Ray D. Lillibridge, on behalf of the Stanley Electric Mfg. Company, showing the Standard and Bay Counties transmission in California brought up to date, with circuits extending 232 miles across the State from the new De Sabla power house all the way into San Francisco, and Sansalito. An excellent feature of the map is the introduction of halftone views of the work at various points. The lines can be clearly traced all over the Sierras, across rivers and plains, and a very graphic idea is presented of what has been done. The map is about 3 feet long by 2 wide and has cross bars as well as a cord for suspension. It is a useful ornament for any office or plant.

ALLEN SOLDERING FLUXES.—The L. B. Allen Company, Inc., Chicago, Ill., has just issued a neat little pamphlet describing its soldering stick, soldering paste and soldering salts. These fluxes are especially adapted for all kinds of electrical work, on any kind of metal, the solder filling every crevice in a joint, giving a solid, firm, smooth, flush joint that is said to be stronger than the material so united. This substance does not corrode the wire nor affect the insulation. The sticks are 6-in. long and 1-in. in diameter. The soldering paste is preferred by some because it can be applied with the finger or a cloth or splint, and it permits of access to places that can not well be covered by the use of a soldering stick. The solder can be made self-fluxing by simply dipping it into the soldering paste. The paste acts equally well on fine work or on heavy connections and never fails to hold the joints. The salts come in a bottle and are ready for use after adding water. The use of these fluxes of different forms saves much time. Allen's commutator lubricant is another product of this company that is well known, and is guaranteed to stop sparking and carbonizing on any dynamo or motor, and is a preservative of the commutator, besides being a lubricant. Al-lectro polish is another Allen compound that has a very wide use. It is a metal polish, and is highly recommended for burnishing brass, copper, nickel, aluminum, etc.

ELECTRICAL BOWLERS.—The first annual outing of the Electrical Bowlers' Association of New York City was held on Saturday, June 18, 1904, at Eckstein's, West Brighton, S. I. An invitation was extended to the New York office employes of the Sprague Electric Company, which courtesy was highly appreciated, as shown by their representation on this occasion. During the afternoon, an interesting and exciting game of baseball was played. One side was made up principally of Sprague men and was known as the "Unglazed Cleats." The other team comprised members of the Electrical Bowlers' Association and was identified as "Keyless Sockets." A special feature of the game was the all-around playing of Messrs. Hubner, Hill, Young, Merrill, Simes and Leveridge. The splendid base running of Harry Young and the running catch of a high fly ball by Frank H. Hill were worthy of special mention. The heavy batting of the "Unglazed Cleats" evidently was too much for the "Keyless Sockets," and the game concluded with the "Cleats" being victorious by a score of 26 to 11 runs. Following the baseball game, dinner was served in the dining-room of the hotel. In the evening, a bowling match was arranged by W. B. Tretheway, captain for the "Unglazed Cleats," and R. Simes for the "Keyless Sockets." The game was won by the "Cleats," who again showed their supremacy, by approximately 100 pins. Messrs. Tretheway, Young, Bourgeois and Johnson rolled in very good form, making high scores. Among the others present were Hon. Jno. Waldman, J. Rice, "Pop" Ruete, J. Cook, F. King, C. Wilson, M. McNiff, B. Gothberg, John McCaughey.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JUNE 28, 1904.

[Conducted by Rosenbaum & Stockbridge, Patent Att'ys, 140 Nassau St., N. Y.]

763,350. LIGHTNING ARRESTER; Garrison Babcock, Chicago, Ill. App. filed April 18, 1904. A fusible strip is held under compression between two corrugated carbon plates.

763,351. SELECTIVE SIGNALING SYSTEM; Garrison Babcock, Chicago, Ill. App. filed May 18, 1903. (See page 66.)

763,355. ELECTRIC FIXTURE SUPPORT FOR OUTLET BOXES; William F. Bossert, Utica, N. Y. App. filed Jan. 9, 1904. To line up the coupling, it is provided with a spherical surface, abutting against a spherical seat in the box upon which it may be rocked and secured at any angle.

763,364. THIRD RAIL FOR ELECTRIC RAILWAYS; Jacob Caesar, New York, N. Y. App. filed March 2, 1903. The rail has a thick central portion and outwardly inclined flanges on its under side, with one of which the supporting brackets are connected, the current being taken from the under side of the rail between the flanges.

763,366. LOCK FOR LEVERS IN INTERLOCKING MACHINES; John P. Coleman, Edgewood, Pa. App. filed Oct. 8, 1903. Details of an arrangement of toggle and latch levers in connection with switch interlocking mechanism.

763,379. ALTERNATING-CURRENT INDUCTION MOOR; George B. Dusinberre, Edgewood Park, Pa. App. filed Dec. 29, 1902. (See Current News and Notes.)

763,386. ALARM DEVICE; Elbert L. Fitch, Highland Mills, N. Y. App. filed Dec. 12, 1903. A cord network is stretched over a window and connected with a switch in such a manner that any disturbance of it will release the switch and send an alarm.

763,390. ELECTRIC RAILWAY SWITCH; Edward A. Gray and Silas H. Brand, Chicago, Ill. App. filed Feb. 11, 1904. The two magnets serving to throw the switch tongue in opposite directions respectively, are connected in circuit when the wheels of the car run upon insulated plates secured to the tread of the rails.

763,404. SWITCHBOARD APPARATUS; William Kaisling, Chicago, Ill. App. filed Jan. 13, 1903. (See page 66.)

763,411. AUTOMATIC ELECTRIC BLOCK SIGNAL; William A. Luby, Kalamazoo, Mich. App. filed June 25, 1903. Details.

763,412. AUTOMATIC ELECTRICAL EXCHANGE; Frank A. Lundquist, John Erickson and Charles J. Erickson, Chicago, Ill. App. filed Dec. 2, 1893. (See page 66.)

763,420. AUTOMATIC SIGNALING SYSTEM FOR RAILWAYS; William N. Owen, Conway, Ark. App. filed Oct. 7, 1903. Details of a block signaling system.

763,434. INSULATING SUPPORT FOR ELECTRIC THIRD RAILS; Frederick R. Slater, New York, N. Y. App. filed May 28, 1903. A clamp is anchored to the top of the string-piece and grips between two lips the web of a T-rail.

763,435. CONTACT DEVICE FOR UNDER CONTACT THIRD RAILS; Frederick R. Slater, New York, N. Y. App. filed June 20, 1903. The shoe makes under contact by gravity with the rail, but a spring is applied in a manner to prevent chattering.

763,464. CIRCUIT CLOSING DEVICE; Albert B. Chance, Centralia, Mo. App. filed April 6, 1903. Details of a cam-switch for telephone circuits.

763,495. ELECTRIC LIGHTING SYSTEM FOR VEHICLES; John A. Little, St. Louis, Mo. App. filed Oct. 3, 1903. An axle driven dynamo having a number of circuits on its armature, one of which energizes a battery and another certain electro-magnetic devices for controlling the flow of current through the battery.

763,501. ELECTRIC TRANSMITTER; Arthur J. Mundy, Boston, Mass., and Albert E. Smith, Waltham, Mass. App. filed Sept. 8, 1903. (See page 66.)

763,509. TROLLEY GUARD AND FINDER; William F. Reicherbach, Rochester, N. Y. App. filed Oct. 15, 1903. Details.

763,510. MAGNETO ELECTRIC GENERATOR; Benjamin P. Remy and Frank I. Remy, Anderson, Ind. App. filed March 14, 1903. A body of iron forming the core and pole pieces of the armature, is hand-adjustable to regulate the time of generation of the ignition currents with respect to the movement of the gas engine shaft.

763,515. TRAIN OPERATED TIME SIGNAL SYSTEM FOR RAILWAYS; William B. Severance, Auburn, N. H. App. filed Nov. 10, 1902. An indicator shows the length of time elapsing after the passage of a train and is actuated by circuit closers connected with the rails.

763,516. APPARATUS FOR DEMONSTRATING THE EFFICIENCY OF LIGHTNING RODS; Harvey Simpson, Burlington, Wis. App. filed Feb. 29, 1904. A model house equipped with a lightning rod, a battery and a discharge conductor for illustrating the action of the lightning rod.

763,520. ELECTRIC SWITCH; Walter S. Tobie, Augusta, Ill. App. filed Feb. 10, 1904. Details.

763,540. RAILWAY SIGNAL; John P. Coleman, Edgewood, Pa. App. filed Feb. 2, 1903. The signal is operated by compressed air under control of electro-magnetic valves.

763,547. ALTERNATING-CURRENT INDUCTION-MOTOR; George B. Dusinberre, Edgewood Park, Pa. App. filed Feb. 27, 1904. (See Current News and Notes.)

763,563. SIGNAL; Harry L. Jennings, Clifton, Arizona Territory. App. filed Jan. 23, 1904. An electric lamp is placed in a semi-spherical lantern having a screen in front containing advertising matter which when thrown into view automatically closes a circuit to the lamp.

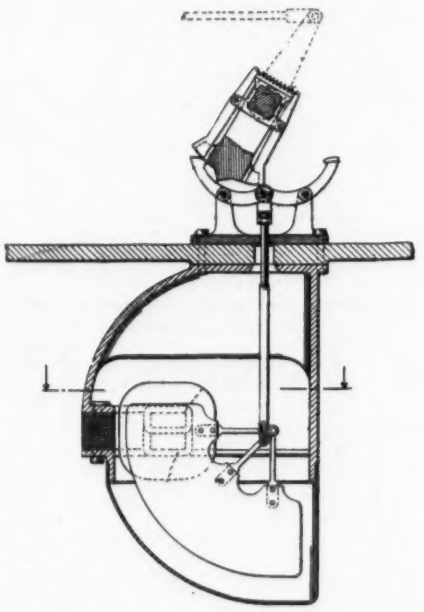
763,575. SOUND COLLECTING AND MAGNIFYING DEVICE; Charles H. Viggars, Milton, Mass. App. filed May 11, 1903. A microphone transmitter is placed at the small end of a megaphone and the former connected with an ear-piece adapted to amplify the sounds.

763,613. AUTOMATIC SIGNAL; Thomas F. Keating, New York, N. Y. App. filed Jan. 14, 1903. A visual signal located at the rear of a car or train, is thrown into circuit automatically by the application of the train brakes.

763,615. POTENTIAL VARYING AND CURRENT REVERSING APPARATUS; Maurice Laur, New York, N. Y. App. filed Sept. 4, 1903. For the purpose of gradually shifting current from one set of lamps to another, two carbon rods are arranged in connection with a traveller in such a manner that the resistance of one rod is gradually thrown into one lamp circuit while that of the other is correspondingly cut out.

763,657. ELECTRICAL APPARATUS FOR THERAPEUTICAL PURPOSES; John O. Brown, Rogers, Ark. App. filed April 20, 1904. An electric belt.

763,658. CONTROL OF DYNAMO ELECTRIC MACHINERY; Eugene R. Carichoff, East Orange, N. J. App. filed Aug. 1, 1901. In multiple unit control systems, a series of magnets controlling switches in the motor circuit, a master switch, an actuating circuit for connecting and disconnecting the magnet and a source of current, a maintaining circuit and means adapted to include the magnets successively in the actuating circuit and to shift each magnet when it has operated to the maintaining circuit.



763,366.—Lock for Levers in Interlocking Machines.

763,741. PUMP CONTROLLING APPARATUS; Geo. V. Ellis, New York, N. Y. App. filed Jan. 18, 1904. As the level of water rises to a height requiring its discharge, a liquid pressure is opened to prime or fill the pump and simultaneously throw the pump controller to start the operation of the pump.

763,754. THERMOSTATIC DEVICE; Christian Frederick Hilkier, Copenhagen, Denmark. App. filed Jan. 22, 1904. (See Current News and Notes.)

763,755. COMBINED TELEPHONE RECEIVER AND TRANSMITTER; Johan Gunnar Holmström, Stockholm, Sweden. App. filed Aug. 14, 1903. (See page 66.)

763,759. TROLLEY; Geo. A. Hunsinger and Edward A. Dewald, Allegheny, Pa. App. filed Jan. 20, 1904. Four horizontal rollers are arranged in two pairs above the trolley wheel, to prevent the latter from leaving the wire.

763,766. SIGNALING MEANS FOR RAILROADS; Horatio A. Johnson, St. Paul, Minn. App. filed Nov. 9, 1903. Circuits by which a train dispatcher can set signals to stop a train and then communicate with its crew.

763,772. APPARATUS FOR WIRELESS TELEGRAPHY; Guglielmo Marconi, London, England. App. filed Nov. 10, 1900. (See Current News and Notes.)

763,774. ALTERNATING CURRENT MOTOR; Mitford C. Massie, Washington, D. C. App. filed Feb. 12, 1904. (See Current News and Notes.)

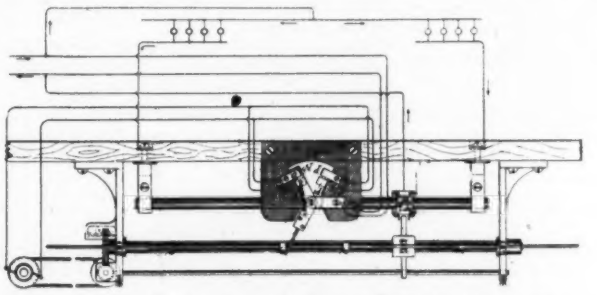
763,803. SIGNALING SYSTEM FOR TELEPHONE EXCHANGES; Charles E. Scribner, Chicago, Ill. App. filed Oct. 26, 1901. (See page 66.)

763,812. RESISTANCE FOR ELECTRICAL USES; James F. Tracy, Pittsburg, Pa. App. filed Dec. 12, 1903. Finely divided cast-iron, steel, wrought-iron, etc., or a mixture of two or more materials thoroughly intermingled, is contained in a non-conducting tubular holder to which contact pieces are secured and electrically connected to the inner core, the object being to produce a motor starting box which is capable of withstanding much abuse and which, when injured, may be repaired at small cost.

763,820. TROLLEY POLE; Andrus S. Weaver, Joy, N. Y. App. filed Aug. 19, 1903. The upper end of the pole folds downward in case the wheel leaves the wire.

763,845. MEANS FOR SECURING THE STATORS AND ROTORS OF ELECTRICAL MACHINES IN ADJUSTABLE RELATION; Hans Bohmlander and Rudolph Pfeifer, Charlottenburg, Germany. App. filed Feb. 24, 1902. By means of adjusting devices interposed at numerous points of the circumference of the rings, the latter are capable of being adjusted accurately to a concentric position with respect to the rotor.

763,861. ELECTRIC REGULATING SWITCH; Henry W. Wartnaby Dix and John Sandford, Birmingham, England. App. filed Dec. 21, 1903. A circuit controlling device comprising a number of stationary contacts and a



763,615.—Potential-Varying and Current-Reversing Apparatus.

helical contact which is rotated and moved axially at the same time to gradually engage the contacts.

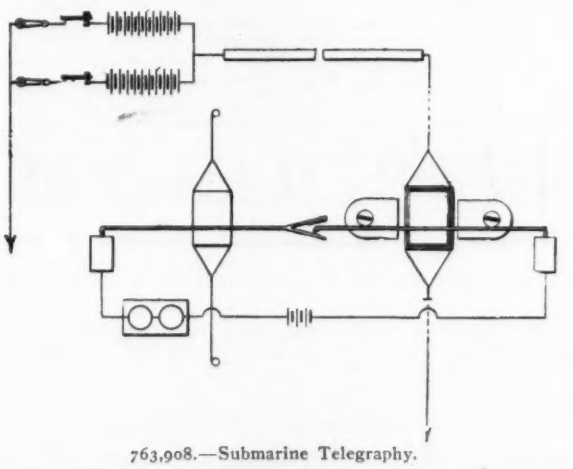
763,890. SAFETY GRATING; Gustav T. E. Henriksen, Milwaukee, Wis. App. filed Dec. 2, 1903. A grating for jails in which each bar is a tube containing a rod that is permitted to drop and close a circuit in case the bar is rotated.

763,893. WIRELESS TELEGRAPHY; William S. Hogg, Washington, D. C. App. filed Sept. 22, 1902. The energy is taken from the aerial wire by electrostatic induction and the device employed is of such a character as to intensify the oscillations induced in the coherer circuit, and at the same time prevent atmospheric discharges from affecting the coherer.

763,894. COHERER; William S. Hogg, Washington, D. C. App. filed Feb. 9, 1903. A German silver wire is highly heated, then rubbed with selenium and heated again to drive off uncombined selenium and then mounted in contact with a steel needle; this produces a crystalline mixture of selenids, sensitive and self-decohering in action.

763,908. SUBMARINE TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 22, 1903. The method of receiving cable messages consists in inducing through the movement of the receiving device a corresponding movement in a mechanically independent relaying device, and actuating through both movements a local circuit.

763,911. CALL-REGISTER FOR TELEPHONE SYSTEMS; Jacob W. Lattig, West Bethlehem, Pa., and Charles Lane Goodrum, Philadelphia, Pa. App. filed June 6, 1903. (See page 66.)



763,908.—Submarine Telegraphy.

763,921. ELECTRICALLY CONTROLLED AUTOMATIC BLOCK SYSTEM FOR OPERATING RAILWAY SIGNALS; Alfred Oesterreicher, Vienna, Austria-Hungary. App. filed Oct. 4, 1902. Block instruments and motors are located at stations along the line and are connected by two conductors which alternately convey the current, and one common return conductor.

763,939. AUTOMATIC TRAIN SIGNALING AND RECORDING SYSTEM; Frank R. Wood and Daniel F. Shamberger, Sparrows Point, Md. App. filed Aug. 24, 1903. A series of main line wires including a number of signaling devices arranged at predetermined distances along the line, together with a number of time stamps, one for each line wire and all of which are located at a central station.

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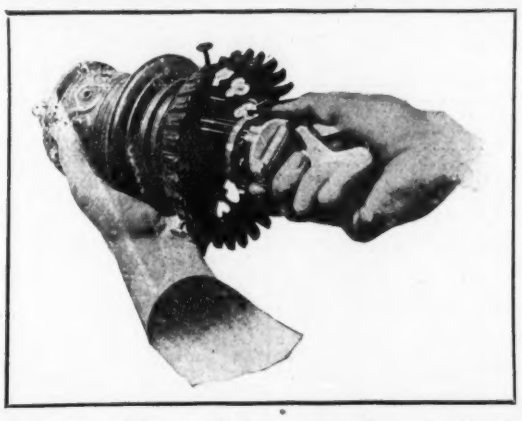

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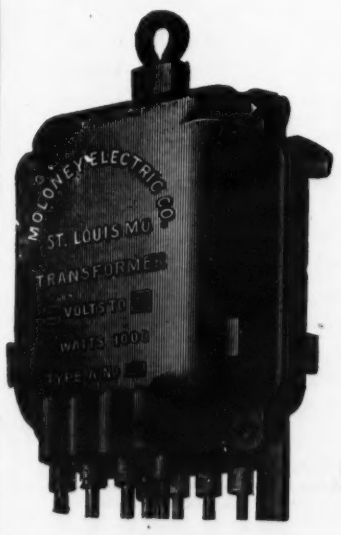

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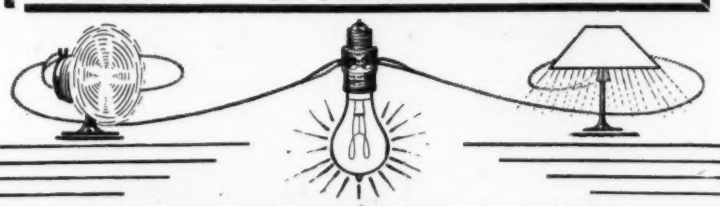

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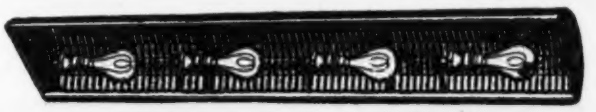

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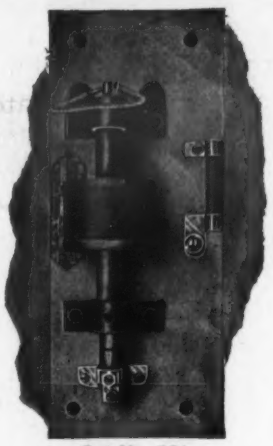

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